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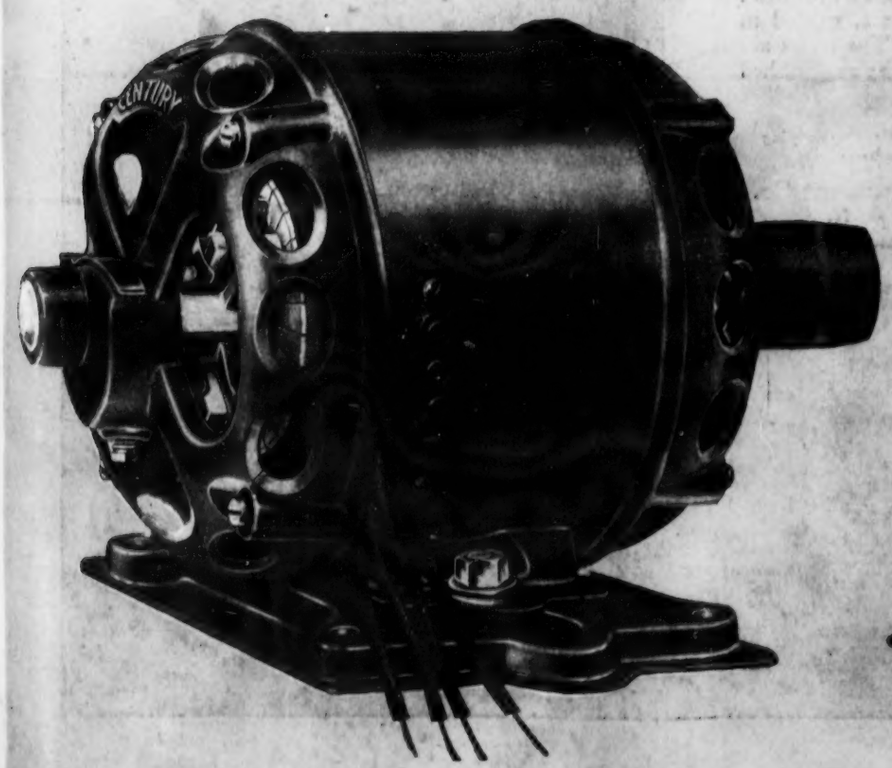

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Water-Power Development in Sight

THE passage of the so-called "administration" water-power bill by the Senate a week ago is a matter of congratulation for the industry. Never before has the legislative situation been so favorable for the final enactment of a water-power measure. While the "administration" bill passed the House and the Senate at the last session, the conference committee report was caught in the legislative jam at the closing session and died with the Congress. For a decade the urgent necessity of water-power legislation has been brought before various Congresses. Numerous bills were presented and passed in one of the houses of Congress, but agreement could not be had in both. The most famous of these former bills were the Ferris and Myers bills and the Adamson and Shields bills. Certainly none of the measures was so all-embracive as the present one. and it is generally agreed that capital can be commanded for development under its provisions. In its main features the bill provides for a commission to control all water power on navigable streams, in public lands and in the forest reserves; a fifty-year lease, and recapture by the government. Preference is given to national, state and municipal governments in the matter of priority of licenses and also in the matter of charges. The entire burden of sustaining the cost of the administration of the act, however, will fall upon private citizens and corporations who care to take out licenses. No doubt some modifications will be made in the act by the conferees, but the main features of the bill will remain, since both houses are in agreement on essentials. Its final enactment into law may be expected in the spring, and while the measure is not so deep as a well nor so wide as a church door, 'twill serve so far as the electrical industry is concerned. The sooner the bill is signed, sealed and delivered, the better.

What may be looked upon as electrical freaks and fads to-day may become standard practice to-morrow if they are based on sound engineering principles. There may be exceptions, but anything scientifically correct cannot easily be overthrown.

Richard Cockburn Maclaurin

THE sudden death of President Maclaurin of the Massachusetts Institute of Technology almost at the moment of greatest rejoicing in the history of that great school formed a tragic climax to an endowment drive of overflowing success and has deprived the world of science and education of one of its master minds. The work of this modest savant, who combined in an unusual way the qualifications of a legal expert, a mathematical physicist, a philosopher and an executive educator, can hardly be appraised in a few lines of type; but there is no question that the sixth president of "Boston 'Tech'" will go down in history as one of its most constructive leaders, foremost as a good citizen, and influential on behalf of breadth and depth of engineering on more continents than one.

He was no cloistered recluse, but a man among men, fired with the insight of a practical imagination, devoted to the last to the upbuilding of civilization through trained agencies, at home in the library of the philanthropist and alike welcomed by students and representatives of the people. Deeply versed in science and himself a specialist of renown, Dr. Maclaurin appreciated to an extraordinary degree the mutual obligations of science and industry, and with all the power of his great personality he strove for and achieved their greater recognition. His tasks on earth are finished—too soon, from the human standpoint—but they were not finished until the great institution whose buildings and whose life bear eloquent testimony to his self-sacrificing zeal had attained a maturity and preparedness for future service which must long have been the vision of its lamented and honored chief executive.

A subdivision of gross revenue and profits from the sale of electrical merchandise should be a standardized practice of central stations. To lump together gross appliance sales without analyzing their make-up throws little light upon the wisdom of a commercial policy. Besides, it is poor business.

The Doctrines of Goodwin

ELECTRIC service to-day is all-embracing. It requires the product of thousands of widely separated generating stations and the output of three thousand electrical manufacturing plants to make electricity available in our homes, offices and workshops. It is just as available to the humblest home as to the largest factory. To make this possible an army of workers has been required equal in number to the American fighting force which was sent to France—an army similarly made up of field divisions and stay-at-home divisions—contractor-dealers and jobbers representing the first division and manufacturers and central stations representing the second division. The building of this army has called for and still demands the finest skill of the engineer and the business man, for to-day the electrical industry has developed commercial problems that are governed by the same business principles that govern any other pursuit where completeness of service to the masses is a measure of success.

Although this fundamental fact has been recognized from the start, it has required the exigencies of a great war and the results of indifference, selfishness and greed in unscrupulous competition to bring about a trade co-operation in supplying the demand for elec-

trical service. In pointing the way to the proper functioning of central stations, jobbers, retailers and manufacturers, the homely philosophy of William L. Goodwin has during the past two and one-half years worked as leaven in the bread. From the West to the East and up into Canada he has spread the doctrines of a new spirit of trade co-operation in which the service of the retailer must not only be recognized but solidly established and the various interests in the electrical industry made to work in harmony so that there may be established a retail distribution of electrical goods at fair prices to the consumer and at fair profits to all parties to the transaction. Moreover, he is preaching these doctrines with the knowledge that the retailer will not only sell more goods but create a broader conception of the value of electric service in the minds of the American public. For instance, a washing machine sold by a prosperous and enthusiastic contractor-dealer is most effective support for the central station in cultivating favorable public relations. To convince all of the skeptical and accomplish all that these principles stand for in a night would be expecting too much, but the Goodwin plan is well launched and will gain in strength as its benefits are better known. In last week's issue some of its benefits to central stations were reviewed, and in this number what has been accomplished for the jobber, the contractor-dealer and the manufacturer is outlined.

How wasteful of our national water-power and fuel-power resources we of 1920 will appear to posterity when it looks back at us from the year 2000! No doubt our descendants will wonder why we could not develop men with vision and ability enough to save for them some of their national birthright.

Vector Diagram Subscripts

THE alternating-current circuit is the home of the plane vector and the field of application for vector diagrams. Such vectors may be regarded as divisible into two species, namely, first, numerically derived vectors, representing complex numbers, as when an alternating current obtained by dividing a voltage by an impedance is indicated as a line of length and direction to fit the required amplitude and phase, and, second, geometrically derived vectors which are laid down on the basis of place displacement without resorting to complex numbers. For example, when we mark off a delta or star connection of three-phase electromotive force, these vector diagrams do not necessarily involve any reference to complex numbers.

Whether vector diagrams represent arithmetical or geometrical concepts, their usefulness in connection with alternating-current circuits is very great. Indeed, they are almost indispensable to a clear comprehension of alternating-current circuit phenomena. It is necessary, however, to adopt a certain technique in the use of vectors if misunderstanding is to be eliminated from the mind of the writer or the reader, or both.

Lewis A. Terven draws attention in the article printed in the ELECTRICAL WORLD for Jan. 10 to the desirability of using two-letter subscripts in delineating and describing vectors. This practice has been indorsed by a number of writers. The article gives several useful examples of vector diagrams in which the two-letter subscripts are easily set in their proper order, but which might easily be brought into error if the subscripts were omitted. The principal point to be remembered is that a reversal of the order of subscript letters is equivalent to a reversal of the vector.

Meter connection problems in relation to polyphase circuits are sometimes very complicated, especially when both voltage and current transformers are involved. As indicated in the article, the subscript vector diagrams of these cases are very helpful in clearing up the complexity.

While individual systems may grow at only a moderate rate, an interconnection of large capacity necessarily results in an immediate large concentration of power. Facilities and methods which are adequate for the isolated systems immediately become inadequate for the interconnected systems, and expansion becomes imperative.

Preparation for Rate Advances

THE necessity for increased charges for electrical energy may appear self-evident to the central-station manager confronted with the rising cost of operation, but something more than general statements is essential in bringing such knowledge home to the local public. A good many public utility executives do not realize the importance of making out a sound case from the standpoint of the ordinary business man, but appear to think that if a few items like recent wage increases, present-day coal prices and typical repair outlays are set forth, nothing further is necessary. In a time like this, when material can be found on almost every side to demonstrate the inadequacy of many existing rates, an executive who fails to handle the subject comprehensively lays himself open to the charge of poor management.

The public in many places is thoroughly alive to the value of data filed by operating companies in their returns to the state commissions and makes no hesitation in using this information in attacking a rate increase. Hence it is most important from the company viewpoint to present data in defense of rate changes which are consistent with these returns, and if apparent discrepancies are evident, let the reasons therefor be made plain. The value of a complete record of plant and system operation is not always sufficiently appreciated in connection with the preparation of advertisements, press statements, circular letters, petitions and briefs advocating higher rates. Thus, if a company using both steam and hydro-electric generating units is obliged for a period during plant reconstruction to burn more and perhaps poorer coal than normally, this factor in cost increase should not be overlooked in analyzing the operations of the period for popular interpretation. Specific information as to the number of days or hours of extra steam service required will be accepted by the public at its face value; whereas if a general statement only is made, covering the net increased cost per kilowatt-hour for the year, let us say, the opponents of a rate advance will frequently attack the figures as misleading in the light of the company's performances over an earlier and more efficient period. If certain allowances are increased in the final new rate per kilowatt-hour set by the company, the management should be prepared to show their reasonableness; otherwise the gap existing between the obvious cost increase and the proper advance to cover all local conditions may be charged up by the representatives of the public to mere profiteering.

A mere announcement that the cost of coal has risen from the former to the present level forms in many cases a most inadequate plea for revised rates, although it may justify radical changes in the schedule of charges. All along the line the reserve information at the manager's hand should be brought into action. Figures used should be used accurately and should check whenever possible with published information. A little care in preparing for rate advances is worth many times its cost.

It is gratifying to see the steady progress in National Electric Light Association affairs. The committees, the officials and the headquarters staff are getting many matters in fine shape for presentation at the 1920 Pasadena convention.

Induction-Motor Wiring Rules

WE WERE glad to call attention a week or two ago to the subject of the rules commonly enforced in the installation of induction motors, a topic on which this journal has touched before. The point here at issue is the confusion which seems to exist in the minds of certain inspecting authorities regarding the practical distinction between starting and running currents in induction-motor service. It is perfectly possible to start an induction motor with very moderate currents, just as one can start a direct-current motor very gently if necessary. As a matter of fact, the induction machine is so rugged in constitution that it is neither necessary nor desirable to go to the complication required in gently starting it by slow degrees unless this result is in itself important to be attained. If the direct-current motor were as tough as the induction motor, and like it sparkless under all conditions of operation, it would be similarly treated. Practically most induction motors have rotors of the squirrel-cage persuasion and are started at reduced voltage by a compensator, unless they are small enough to be thrown squarely on the lines. The torque characteristics of the induction motor are such that starting with a compensator implies a rather heavy demand for current over a very brief period while the rotor is gathering speed. When thrown over on to the running points this current is diminished to the running value for the required load. The motor cannot come to speed until the compensator is thrown to the running points, and consequently there is no danger of its being left to run under starting conditions. Even if it were so left, if it were properly fused or even approximately so, it would be automatically cut out of circuit.

Now, the protest which we here voice, coming from some very good judges of induction motor practice, is against the installation rules which demand that the branch wiring to the motor must be of a size which corresponds to permanent use of the currents met during starting, and in which no distinction is made between this brief starting current and the running conditions, possibly of overload. There is no possible reason for demanding that the wiring itself should in the ordinary case be such as to carry permanently, with conservative rise of temperature, the whole starting current, since this current is heavy for only a few seconds. The wiring in fact need only be heavy enough to carry the full overload current met with in the motor in service, perhaps a maximum overload of 25 per cent. If this wire be fused properly so as just comfortably to carry the starting current under normal starting conditions, it will be adequately protected as regards running conditions from severe overload. The motor will stall long before it will burn out, and the fuse will take care of the situation. In other words, the starting-fuse capacity should be separated entirely from the copper capacity since the former depends on temporary conditions only, the latter upon more or less permanent ones. Every properly made fuse has a sufficient overtime lag to transmit the momentary starting current and yet act on a continued overload. And it is only in the latter case that the size of wire cuts any figure. By grouping motors of similar characteristics it is easily possible and certainly desirable to produce standard regulations for installation which will save a great deal of copper now wasted and at the same time meet all the requirements of safety.

If any central-station company has misjudged its true costs of operation in the past, it has a large obligation to itself to avoid any error of this character in the future; and not only to its corporate self does it owe this duty but it owes it also to security holders, to employees and to the people.

Hydro-electric Power Conserves Materials

THE worldwide shortage of completed products brings home to the engineer the importance of conserving materials and finished equipment alike. The economical use of productive resources is incumbent upon us all. Where simpler forms of equipment will answer the purpose, now is the time to utilize these, and in this connection a close adherence to well-established standards in design is very helpful. Fixed costs are too high to justify as free a hand in designing and specifying apparatus as would ordinarily be the case.

Hydro-electric plant development is peculiarly advantageous from this point of view. Comparatively little, we believe, has been said about the conservation of material and equipment involved in such projects, but the engineer who contrasts the amount of labor and fabricated material required to provide a steam plant of given capacity with that needed for an equivalent hydro-electric station will be surprised at the difference in favor of the water-power station. Even though the initial investment cost per kilowatt of primary power may be greater in some cases in the hydraulic plant, considering the cost of reservoirs, dams, pipe lines and headworks, the drain upon the manufacturing resources of the country is in general less with the hydro-electric scheme, owing to the complication of boiler-plant equipment and auxiliaries associated with steam-power production. The relative simplicity of the hydro-electric installation affects the entire productive cycle, including raw material assembly, designing, shop work, transportation, permanent outlay in highly specialized auxiliary equipment and structural intricacies.

Steam generating plants bid fair to retain their firm hold upon the power equipment market for a long time to come, and few mistakes are more easily made than to assume that water-power developments *per se* are inevitably justified in competition with steam stations. But the country is in sore need of the water power which only awaits the establishment of a sound and encouraging policy on the part of the government to go forward, and among the many arguments in favor of this immensely important work conservation of material and equipment is far from the least.

Problems in Electric Furnace Smelting—I

Furnace Losses Are Greatly Decreased by Rearranging Transformer Leads—Irregularities in Operation Between Electrodes of Shaft Furnace Are Discussed and Remedies Pointed Out

BY F. HOLMGREN

INTRODUCTION.—It is well known that the earliest blast furnaces were built in Sweden, and Sweden also first successfully developed the electric shaft furnace for the production of pig iron directly from the ore. The reason for this is naturally to be found in the facts that Sweden has an abundant supply of very high-grade iron ore and, besides this, of cheap water power, which is essential for the commercial success of the process. Coal is very expensive in Sweden and with small exception the entire supply has to be imported. It is for that reason that it has been more profitable in the past to export several millions of tons of ore annually, but it is hoped that with the successful solution of the electric shaft furnace and its more general adoption a large part of this ore may be reduced at home and used in expanding the steel-mill industry of the country.

Besides iron ore and limestone, charcoal has in the past been the other necessary raw material, but it is stated that recent improvements in the construction of these furnaces make them equally suitable for the use of coke in place of charcoal. The scarcity of charcoal in the United States is undoubtedly one of the reasons why this type of furnace has not been more extensively tried out in this country, and if it be true that coke is a satisfactory reducing agent, we shall undoubtedly soon find many of these furnaces installed here.

There are at present thirteen of these furnaces in operation in Sweden and four under construction in ratings up to 6000 kw. each. There are also seven under construction in other countries, several of which are said to be for use with coke as a reducing agent. The productive capacity varies from three to four tons of pig iron per kilowatt-year, depending on the quality of the iron produced.

The following article is of considerable interest in that it deals with a number of investigations which were made on existing furnaces in order to determine the best arrangement of electrodes, leads, etc. In one case the losses were reduced from 474 kw. to 282.5 kw. by changing the connection from transformer leads to electrodes. The power factor, moreover, was raised from 0.7 to 0.91. The article also explains the intimate relation between the electrical and metallurgical phenomena within the furnace, and how the operation of the furnace can be controlled for the highest output by a close observation of the electrical measuring instruments. E. A. L.

INVESTIGATION OF FURNACE OPERATION

The Helfenstein Furnace.—The investigations were begun with furnace No. 3 at the Domnarfvet steel works. This furnace was built by Helfenstein and showed the poorest results as regards both operation and power consumption per ton of pig iron. The heat had a tendency to rise higher and higher in the stack and the heat losses were considerable. The electrode potential could not be brought up to the desired value, and it was thought that this was due to too short a path of the current. To overcome this, water-cooled bridges were provided between the electrodes in the furnace dome in order to force the current to pass through the bath. The energy losses in the leads between the transformers and the electrodes were measured by the three-voltmeter method and found to be not less than 17.5 per cent of the total capacity.

The above changes and numerous other tests and trials failed to improve the results, and similar investigations were started at the Soderfors steel works.

The Soderfors Furnace.—This furnace, which is of the "electro-metal" type, had shown much better operating results than the Helfenstein furnace at Domnarfvet, but, on the other hand, the power factor was lower than for furnace No. 2 at Domnarfvet, which also was of the electro-metal type. Electrically, the principal difference in the arrangement was that with the former the transformers were installed in a separate room about 6 m. from the center of the furnace, while for the latter they were placed close to the furnace wall. The frequency in the former case was 50 and in the latter 60.

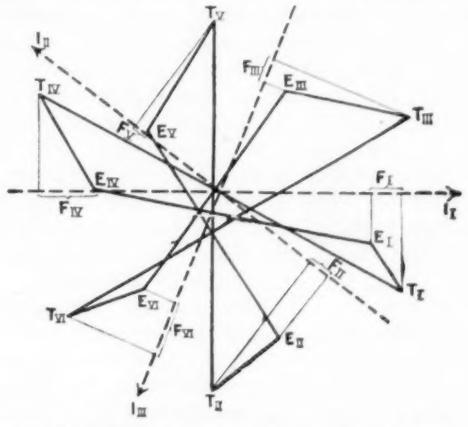

FIG. 1—CURRENT AND VOLTAGE RELATIONS IN SODERFORS FURNACE

I is transformer and *E* electrode voltage. *F* represents power loss.

In these tests complete voltage diagrams were drawn by means of the three-voltmeter method, whereby the losses and the inductive voltage drop in the different leads could be determined. All the measuring instruments had before always been connected to the transformer terminals or near these, whereby the effect of the leads from the transformers to the electrodes was included. This, of course, was not the correct method, as what is most valuable for a study of the furnace operation is a knowledge of the current and voltage at the electrodes proper.

In the first test of the Soderfors furnace a relatively

*Abstracted and translated from the *Transactions* of the Swedish Iron Institute by E. A. Lof.

symmetrical voltage diagram (Fig. 1) was obtained, and the losses amounted to 474 kw. or to about 16 per cent of the total capacity. In the diagram the losses *F* are shown as the projection of the voltage drop on the current *I*. Points *T* represent the transformer terminals and *E* the electrodes. The diagram shows, however, that the furnace was not symmetrically connected,

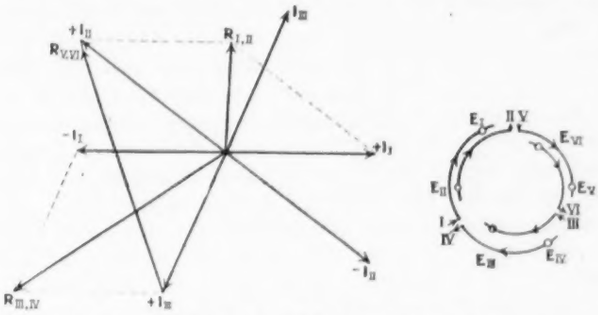

FIG. 2—MAGNETIC FIELDS AND ELECTRODE CONNECTIONS FOR FIRST TEST

R is the resultant magnetic field.

so that the six electrodes will not follow one another in the same sequence in the voltage diagram as in reality.

With currents up to 20,000 amp. or more, which are common with these furnaces, the magnetic fields set up about the conductors become very strong if not compensated for. In this installation, which is three-phase at 50 cycles, the direction of current will change 100 times for each second, and the three currents will be displaced with respect to each other in one-third period. If now the same current is carried forth and back through two adjacent conductors (one going and one return conductor), then the electromagnetic fields set up by the two conductors will be equal but opposite. The conductors will therefore compensate each other, and there will, practically speaking, be no electromagnetic field. If, however, a conductor is placed adjacent to another, and one carries a different current, or current of a different phase from the other, then the electromagnetic field will be greater or less, depending on how the fields set up by the two currents will combine vectorially.

In the diagram Fig. 2 are shown the results from the first test of the Soderfors furnace. The strength and phase displacements of the currents are drawn to scale and represent also the electromagnetic fields set up. Besides this, there is shown in the smaller diagram the leads around the furnace and the direction of the currents therein. The directions of the arrows thus correspond to one another in the two diagrams. We see therefore in the smaller diagram how the arrows of the conductors between electroues *I* and *II* have the same direction, while between the other electrodes this is not the case. The resultant of the two currents, therefore, gives a field proportional to $R_{I,II}$. The two others will, on the other hand, be respectively $R_{II,III}$ and $R_{III,I}$. The electromagnetic fields which thus surround the conductors will be increased by adjacent iron structures which will lower the magnetic reluctance. Such structures are the furnace casing, iron pillars, etc. In these iron parts eddy currents are now in turn set up, which are converted into heat. The less compensated the leads, the greater will be the iron losses thus created. The fields will, besides, set up electromotive forces in the conductors themselves, which may cause a drop and even a rise in the voltage.

Losses Reduced by Interghanging Electrode Leads

The terminals of the transformer for electrodes *III* and *IV* were then changed so that the direction of the current in the circuit was reversed. The result was measured and is shown in Fig. 3. At a first glance it would seem as if the first connection would have been the correct one on account of the symmetrical and otherwise clear vector relations. The unsymmetrical diagram depends, however, on inherent conditions in the furnace which will be dealt with later.

From the diagram it follows that certain losses ($F'_{I,II}$ and $_{II}$) have become negative, that is, that a power increase has taken place instead of a loss. This is readily explained. On account of the above-mentioned mutual induction a certain amount of power has been transformed from one lead to the other, in that the former has acted as the primary winding in a transformer and the latter conductor as the secondary. The adjacent iron structure has served as the necessary "transformer" core. If we consider the fields which could have been formed around the conductors, we find (Fig. 4) that in the latter case these have become much smaller, which must result in lower additional losses. This proved to be the case, as the losses went down to about 375 kw.

The low power factor caused by the relatively large inductive voltage drops (represented in Fig. 1 by the

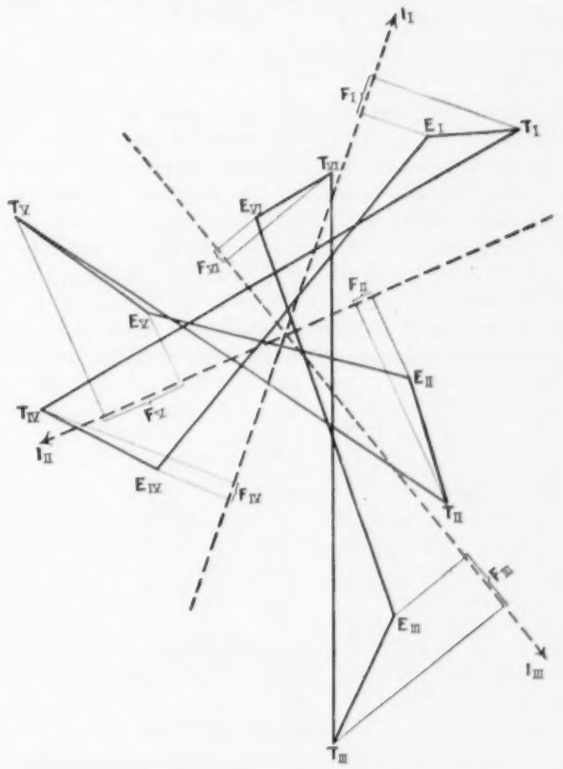

FIG. 3—DIAGRAM WITH LEADS TO III AND IV (FIG. 2) REVERSED

lines at right angles to the currents) could not, as expected, be improved by this reconnection, and it was then suggested that the transformers should be connected to adjacent electrodes instead of to opposite ones as had been done before. Investigations involving the inherent electrical conditions of the furnace

were made, and it was found that this suggestion was practicable.

If we assume that an electrode of circular cross-section with radius r cm. is lowered to a depth of h cm. in a conducting homogeneous mass with a specific conductivity c, then the resistance which the current has to overcome in its travel from the electrode to a concentric cylinder area with the radius R cm. is:

$$M = r\int \frac{Rdx}{x} \cdot \frac{c}{2\pi h} = \frac{c}{2\pi h} \log_e \frac{R}{r} \text{ ohms.}$$

From this we get the voltage

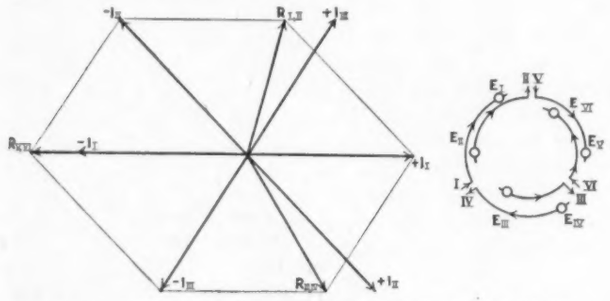

FIG. 4—REDUCED MAGNETIC FIELDS WITH LEADS TO III AND IV REVERSED

$$E = \frac{Ic}{2\pi h} \log_e \frac{R}{r}.$$

The energy production per unit volume will therefore be

$$\frac{dU}{dx} = \frac{1}{x^2} I^2 \frac{c}{2h} = \text{const.} \frac{I^2}{x^2}$$

and will drop rapidly the farther the distance from the electrode.

The zone nearest the electrodes may be considered as consisting of a number of parallel arcs, where the resistance and the voltage drop presumably follow other laws. Oscillograph tests of the applied current and voltage have shown that these have a practically sinusoidal wave shape. Whether this was due to the impossibility of connecting the oscillograph sufficiently near the arc itself, to the heat capacity of the arcs, or to other causes could not be determined. This resistance may depend, however, upon the current density, the temperature, the composition of the charge and the distance between the electrode and the bath. Besides this, the gas currents and finally the electromagnetic field may have their influence.

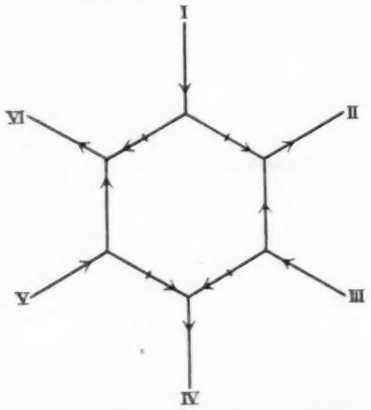

FIG. 5—CURRENTS IN THE FURNACE FOR BALANCED CONDITION
Transformer terminals connected to opposite electrodes. Power factory unity.

It is in this zone where presumably the principal direct energy generation takes place. Outside of the zone, the above laws may hold, excepting that the resistance will increase with a falling temperature. The energy generation drops therefore less rapidly than the formula would indicate. In the former zone we thus have the real "working resistance" and in the latter the "conductor resistance" to the next working zone.

There is no doubt that the "working resistance" preponderates, but it is not quite clear what rôle the "conductor resistance" to the next working zone plays.

This electrical condition with two such zones is known by the term "free" electrodes and represents a normal operating condition. If no arc zone exists, we say that the electrodes are "frozen." This occurs when the potential required for maintaining the arc cannot for some reason or other be produced. The condition appears as a lowered "working resistance" (consequently increasing current), rising temperature in this part of the hearth and reduced production.

Regarding the effect which the "conductor resistance" in the mass itself may have and its effect on the heat development in the furnace, it may be of interest to determine how the different currents proceed through the crucible.

Fig. 5 represents the progress of the currents within the furnace when complete symmetry exists; that is, when the currents in the three phases are equal, the furnace connections symmetrical and non-inductive and when the currents enter and leave the crucible through opposite electrodes. We find that the currents entering will divide according to the parallelogram law into components such that the current between either of the electrodes will be equal to the current entering.

In connection with the first investigations of the Soderfors furnace it was found after the shut-down that the lining was more corroded between certain electrodes than others, and it may be assumed that the greatest effect in the mass took place there. It is, however, difficult to say whether this really had anything to do with the two conditions referred to or to some other circumstance.

It has not been possible to determine the effects of the unsymmetrical condition and the different currents passing through the charge, but from the voltage diagrams it is fairly evident that even the "conductor resistance" of the mass is a factor which must not be lost sight of in considering the heat distribution in the furnace. The diagrams thus show that there is far from a common neutral point, for which reason it must be assumed that work has also been done by the currents in the mass. Cold spots between certain electrodes were thus found in the Soderfors furnace. There is some uncertainty as to the magnitude of the work done in the mass itself between the electrodes and its effect on the thermal procedure within the furnace.

BEST RESULTS BY CONNECTING TRANSFORMER LEADS TO ADJACENT ELECTRODES

Regardless of how the effects are distributed on the arc zones and in the mass itself, we see that the current paths will not be any longer if the transformer terminals are connected to two opposite electrodes than if they are connected to two adjacent electrodes. It was therefore decided to change the connections so that each phase was connected to two adjacent electrodes. The result was, as expected, a considerable reduction of the

losses in the conductors, which went down from 375 kw. to 282.5 kw. with the same operating condition of the furnace. The power factor furthermore was improved to such an extent that from a power consumption of 4420 kva. now only 3395 kva. was required, or a saving of not less than 23 per cent in kva., resulting only from the rearrangement of the leads. The power factor improved from 0.7 to an average of 0.91.

Electro-Metal Furnace No. 4 at Domnarfvet.—This furnace showed, to begin with, the same trouble as the

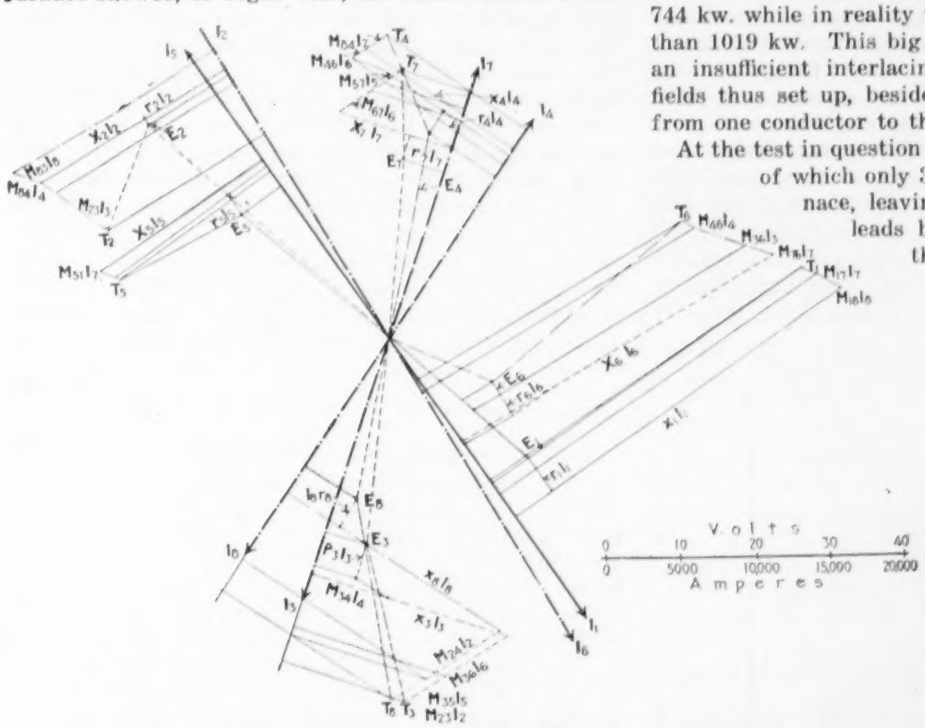

FIG. 6—COMPLETE VECTOR DIAGRAM FOR FURNACE NO. 4 AT DOMNARFVET

Soderfors furnace before the leads were rearranged. Furnace No. 4 has eight electrodes arranged with a double "Scott" connection and is therefore equivalent to a doubling of the set at Trollhättan.

The power factor was found to be low, hangings occurred, and the operation was for this reason uneven at the different electrodes. The leads were arranged as for the Soderfors furnace; that is, the terminals of the respective transformers were connected to diametrically opposite electrodes. Very thorough investigations were made on the furnace.

In Fig. 6 is shown a complete vector diagram for this connection in which the magnitude and direction of the currents and voltages are marked. As there is no real neutral within the furnace, that shown in the diagram will be regarded as fictitious. The great difference, both in magnitude and direction, between the voltages at the transformer terminals and at the electrodes is at once apparent. For electrode 6, for example, the voltage between the corresponding transformer terminal and neutral is about 41 volts, while between the electrode itself and the neutral it was found to be only about 15 volts. The phase displacement with reference to the fictitious neutral was in the former case only about 0.16 and in the latter about 0.8. It is therefore apparent what little help we have from instruments connected to the transformer terminals as a guide for the operation of the furnace.

From this diagram it was now possible to determine approximately the distribution of the losses in the different parts of the conductors, and the values so obtained have been combined in Fig. 7. This shows still more clearly the faulty interpretation one may get from the instruments as regards the load on the different electrodes. So, for example, the wattmeter indicated a load of 1020 kw. for electrodes 4 and 8, while in reality the electrodes only received 637 kw. Still more peculiar is the result at electrodes 2-6, where the meter indicated 744 kw. while in reality the electrodes received not less than 1019 kw. This big difference can be explained by an insufficient interlacing of the conductors and the fields thus set up, besides the transformation of work from one conductor to the other.

At the test in question a total of 3942 kw. was applied, of which only 3392 kw. was useful in the furnace, leaving a 603-kw. loss in the 80-m. leads between the transformers and the furnace. These were segregated as follows: Losses in the contact terminals at the electrodes, 122.2 kw.; in the leads themselves, 164.2 kw.; in surrounding iron structures, 316.6 kw.; total, 603 kw.

From one set of conductors to another there was transformed no less than 544.4 kw. With a rearrangement of the leads to correspond to that at Soderfors it was estimated that the losses could be cut in two. Regarding the furnace leads, these rules can therefore be laid down:

The low-tension conductors should be arranged so that adjacent electrodes are connected to two opposite transformer terminals and that these + and — circuits are carried the shortest distance and in such an interleaved

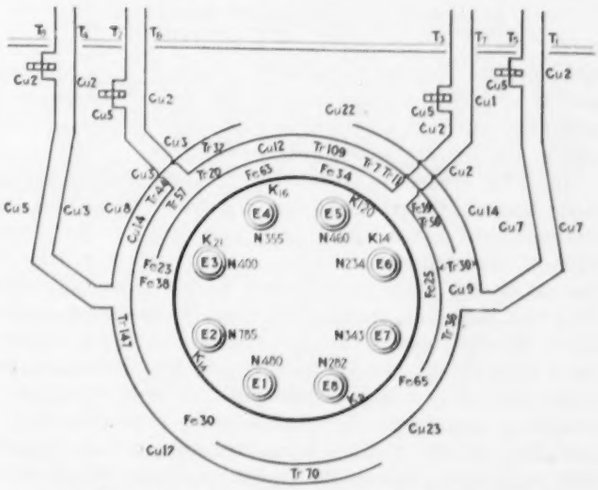

FIG 7—LOAD DISTRIBUTION TEST OF DOMNARFVET FURNACE NO. 4

Cu—kw. copper loss. *Fe*—kw. iron loss. *K*—contact loss. *N*—kw. useful effect. *Tr*—kw. transformer effect. *Ti*—kw. supplied energy.

manner that the magnetic fields will be neutralized.

[This article will be concluded in an early issue.]

The Economic Outlook in Industry

Increased Production and Better Human Relations Must Be Combined to Attain Lasting Success—Surplus Wealth Relatively Small and It Is Needed in Productive Agencies

BY HENRY I. HARRIMAN
President New England Power Company, Boston, Mass.

ONE of the effects of the artificial conditions under which we are living has been to intensify the general belief on the part of the people that there is enough wealth now in existence to make every one comfortable if only there was a proper distribution of it. There is also a very general belief that our present standard of living can be maintained with very much less work than the world is now doing. The huge borrowings of the governments of the world during the war and consequent enormous expenditures, the high wages, the fact that work was done regardless of cost—all have intensified this feeling that there is

HENRY I. HARRIMAN

a boundless amount of wealth which is now unjustly seized by a very small minority and that if it were more equitably divided all could subsist with very much less effort and in very much greater comfort.

In 1914, according to Bowley, $665,000,000 of the annual income from Great Britain went to capital and management after allowing 4 per cent on the actual money invested in industry. Much of this was returned to the state in the form of taxation, but, omitting this payment, it is evident that if the entire amount were divided among the population of Great Britain, each individual's annual income would be increased less than $16. When it is considered that this reservoir of wealth is the source from which new capital is drawn, and that much of it is actually reinvested in productive machinery, it can be appreciated how great would be the loss if this annual income were divided and entirely expended each year.

In America the per capita income increased from $69 in 1850 to $262 in 1910, and the total national income from $2,200,000,000 to $30,500,000,000. These figures indicate enormous expansion of resources and industry, but they also indicate how close is the margin of subsistence; how necessary it is to maintain production at the highest point possible, and how fallacious is the reasoning that there is an unbounded reservoir of wealth which, if equitably divided among all, would give every one all that he desired. Whereas 57 per cent of the wealth of this country belongs to the rich, this same class receives but 20 per cent of the national income; and whereas the poorest class own but 5 per cent of the goods of the country, their income is 38 per cent of the national income. The best figures available show that upon the entire wealth of the United States, estimated at $200,000,000,000, there is not earned over 2½ per cent, or say $1 per person per week, omitting taxation.

MARGIN OF PRODUCTION IS NARROW

Thus the best available figures both for Great Britain and for America show a narrow margin of production upon which mankind must subsist. These figures also show that, while distribution may be faulty, the unequal distribution of to-day is far better than the equal distribution which our Socialist friends desire. The savings of the rich are the source from which the productive capital of the future is drawn. If these savings ceased to exist and there was an equal distribution of property, our present capital would fail to be maintained; we would not be able to add to our available supply, and this failure would result in lowering production and lowering the standard of existence.

In the last analysis the standard of living in any country is what it produces divided by its population. If, for instance, the present output of shoes in America is 300,000,000 pairs per annum, that is three pairs per capita; and if in the future we reduce this production to 200,000,000 pairs, then our standard of living so far as shoes are concerned has been reduced from three pairs to two pairs per capita per annum. So it is in the entire gamut of production. The old Biblical saying, "As ye sow, so shall ye reap," is as true to-day as it was two thousand years ago. If we produce much, there will be much to divide; if we produce little, want, misery and starvation will be the lot of the nation. There is indeed a justice in shortening the hours of labor when it is necessary in order to conserve health and to give opportunities for education, but to shorten the hours of labor beyond such necessity is a crime against civilization. Where that line is it is hard to say, but that it exists and that it is being encroached upon is most evident. The world is to-day short of all kinds of goods, and the need of production was never so great as it is in this year.

The war has worked great havoc in the physical wealth of the world, but it has probably worked even a greater havoc in the psychology of the world's thinking. It is not merely the natural or potential wealth of the country that measures its real progress. It is equally the psychology of the nation, the kind of thinking which

its people do; and I can conceive of few more important tasks than a campaign of education that the people of this entire nation may think straight, may know the facts and may appreciate that only by effort and work can prosperity continue.

The imperative need of increased production brings home to every thoughtful person the question of how this greater supply of goods can be produced. What are the factors that now retard production, and what is essential to increase it? The last century may well be called the age of mechanical achievement. Its early decades witnessed the creation of many of the fundamental inventions which have revolutionized the whole course of the world and given to each worker infinitely greater powers of production. The thought of the world was centered in those early days (and in fact throughout all of the nineteenth century) upon the mechanical rather than the human side of production. The machine was extolled, and the man as a human being was partially forgotten. We conceived that if we could produce much it was of little importance how we produced it, and out of this philosophy came the intolerable conditions of labor throughout much of the last century.

How the Factory Has Changed Conditions

The creation of the factory system also to an extraordinary degree removed the worker from contact with the master. In the days of the small hand-operated plants the owner worked side by side with his men and knew them intimately. But the factory changed this. It put up a barrier between the owner and the workmen, and it is doubtful if the manager or owner of a modern factory knows personally even a small fraction of his employees. The factory system has also added to the monotony of human occupation in effecting such a high degree of specialization in labor. I recently visited a factory where to my personal knowledge a workman for over twenty years had furnished steel blanks to a machine that was making nuts. In season and out for twenty years the same simple mechanical task had been the sum total of his daily occupation. No wonder that his brain was atrophied; no wonder that he had become almost as much an automaton as the machine that he served.

Out of these conditions of factory life have arisen the discontent of labor and its insistence that the human relations shall be improved. Out of these conditions has grown the trade union, at first weak, then growing stronger, until in some trades it has become dominant. Out of these conditions has also grown the discontent that finds its expression in the I.W.W., anarchy and Bolshevism. These are but expressions, crude and unthinking, of the feeling that the industrial system of to-day is wrong, and that the distribution of wealth and the condition of labor is unreasonable. If we are to allay this unrest, we must remove the cause of the discontent; we must eradicate the plague by destroying the infection; and we must recognize that the conditions under which men and women are to work are of the utmost importance.

As the nineteenth century was the century of mechanical achievement, the twentieth century must be the age of bettered human relations, if production is to increase and if the world is to advance, as I believe it will, to a higher and higher degree of civilization. I do not look upon the unrest of to-day as an ill omen; I look upon it as a good sign. Progress has never come from fat contentment. The man who strives and yearns, even though ignorantly and foolishly, is the man who is helping to advance the human race; and it is our function to see that this yearning for better conditions of living, for a greater variety and interest in occupation and for a participation in the conduct of business is granted to the workers. I do not believe for one instant that the capitalistic state is to pass. Capitalism is the only human device ever conceived by which saving was effected; and only as saving is made, only as a part of the great fund of human effort is conserved for the creation of productive machinery, is there any possibility of advance. Not until some other mechanism or economic factor can be shown to have the power of creating saving is there any possibility that the capitalistic state will cease.

Likewise, the wage system is as yet the only means of measuring and recompensing human service which is applicable to many classes of industry. I believe that the wage system will continue, but that it will be modified by profit-sharing, by a bonus and by giving to workmen a greater and greater interest in the management; and I believe that these changes will come because I believe they are necessary in order that human production may increase.

The problems of peace are no less serious than the problems of war. The disorganization of the complicated mechanism of our modern life, particularly in Europe, cannot be rectified without the lapse of long periods of time and the exercise of much patient effort; but as we have won the war, so I believe we will win the peace by self-sacrifice, by bravery, by plainly facing the facts as they are, and then by so rectifying and improving human relations that men will be satisfied because they know they are getting a square deal and because they appreciate from personal knowledge that their share of the total output is fair, reasonable and just.

The Three Fundamental Facts

I have tried to present what seem to me the three underlying facts of the present economic situation: first, that there is no great body of surplus wealth; second, that if we are to prosper we must produce; third, that if we are to produce to the maximum we must improve human relations in industry.

IT IS not a policy of recession that is proposed but a policy of conservation. All progress is the result of economy. In this the government ought always to lead. In a time of national peril economy has a different meaning than at a time of security. We have encountered and overcome our peril. But there is a tendency to maintain the same lavish expenditure. Government expenses must now be reduced from a war to a peace basis . . . . There is a limit to the taxing power of a state beyond which increased rates produce decreased revenue. There is before us a danger that our resources may be taxed out of existence and our prosperity destroyed. — *Governor Coolidge of Massachusetts.*

Progress in the Art of Communication

Development of Machine Switching of Telephone Circuits and Further Applications of Vacuum Tubes Marked the Year 1919—Physical Plant Being Restored After Demoralization Due to War Conditions

BY BANCROFT GHERARDI* AND FRANK B. JEWETT†

THE year 1919 witnessed a very considerable activity in all branches of electrical communication. In addition to new researches undertaken during the year much of the development work which was practically completed during 1918 was finished during 1919 and much work that had been deferred on account of war conditions was undertaken. This was particularly the case in the telephone and transoceanic communication fields.

With the possible exception of long-distance radiotelegraphy, the war very seriously restricted and curtailed the growth of all communication facilities required for normal peace-time conditions. Outside of the United States not only were there no additions to plant to take care of normal growth requirements but in many cases existing facilities deteriorated greatly during the period of hostilities. The situation was particularly acute in the telephone and submarine cable fields. In both of these fields practically no large additions to plant had been made for four years. Further, the old and highly trained operating forces in these fields as well as in the land telegraph field had been greatly demoralized and depleted, and the changed economic conditions made it exceedingly difficult, if not impossible, immediately to re-establish efficient service on the basis which prevailed prior to the war.

Although the situation in the United States during the last year of the war was by no means so abnormal as in most of the other countries, the sudden endeavor to resume business along old channels on a greatly enlarged scale put an unprecedented demand on the operating companies at a time when both material and help were difficult to obtain.

A Period of Strenuous Endeavor

The year 1919 has, therefore, been a period of strenuous endeavor to re-establish communication facilities on a very much enlarged and improved scale. Not only have large additions to plant with the old forms of standard apparatus been undertaken, where such apparatus could be obtained and used to advantage, but new developments which had been retarded during the war were rushed to completion.

While the war was a serious handicap in one way, in another it resulted in a forced development of apparatus and mechanisms which is likely to prove of great value to the communication industry. This is particularly true of the development work which was done on the vacuum tube and its various applications and of the developments which followed the efforts to supplement manual operations by machine operations. With the cessation of hostilities, all of the results of war-time work which might be of interest were immediately scrutinized to determine their adaptability to normal conditions. This scrutiny covered not only the physical but also the changed economic and labor situations. At the present time there is every prospect that the year 1920 will witness a decided improvement over the conditions of 1919, and during 1921 there should be a still greater approach to a satisfactory state of affairs.

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†Chief engineer Western Electric Company, Inc.

Recent Activities in Telephone Field

Machine Switching.—During the year there has everywhere been great activity in the development and production of central office apparatus. Greatly increased and still increasing costs of labor and material, combined with the difficulty of obtaining an adequate supply of operators to give the required service, utilizing pre-war methods, have to a very great extent altered the factors previously existing.

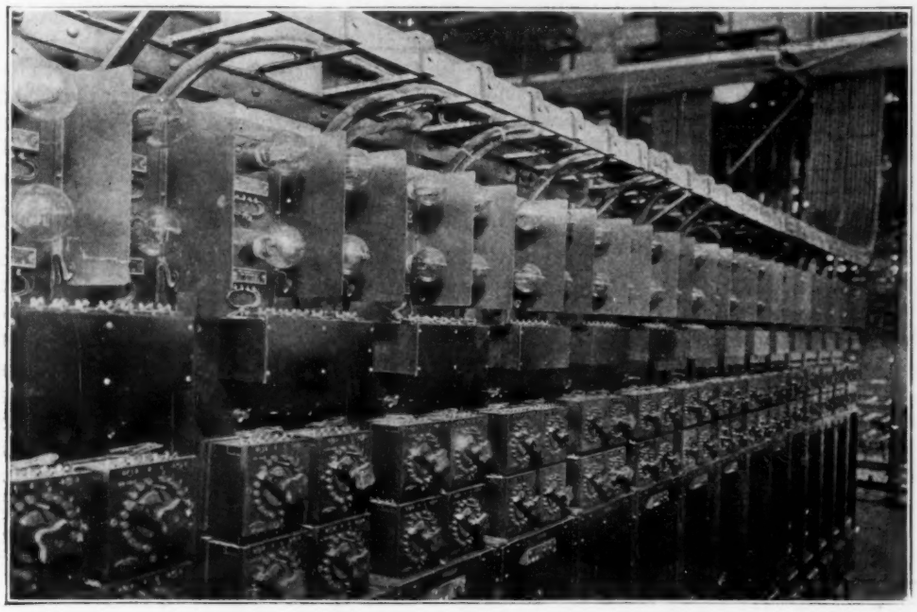
During the year just past a number of the telephone companies of the Bell system have announced plans for the introduction of machine switching or automatic switchboards to provide the additional central office facilities to take care of growth in the large cities. This step has been made possible as the result of studies and development work of the most comprehensive character extending over a number of years and dealing both with the mechanism itself and with the commercial and traffic conditions. Not only have intricate mechanisms been designed and thoroughly tested in service to establish their satisfactory working, but the requirements of the service and the needs of the public have been fully considered. The system and methods which have been developed meet adequately the various service requirements from the point of view of a purely automatic system, and, in addition, they include all of the arrangements needed to provide complete and easy interconnection with existing types of switchboards so that the two work together in an efficient and economical manner. By the use of this type of mechanism to take care of growth and necessary replacements, the telephone companies will avoid the necessity of employing an increasing number of operators for local business, such as would be required if the larger traffic had to be cared for by other methods.

Activities similar to those in the United States are evident in many of the European countries where the conditions are similar to those obtaining here. In some countries, notably the Scandinavian, as in the United States, installation work on large machine switching units is already in progress. In others, such as England and France, the matter of formulating final plans for the ultimate type of equipment to be employed in the large metropolitan areas is under way.

Telephone Repeaters.—During the year many installations of telephone repeaters were made for the purpose of improving transmission over existing circuits or of providing satisfactory commercial service between points hitherto remote. In general the type of repeater which has been installed has been that employing the vacuum-tube amplifier in the so-called two-two circuit described in the paper on "Telephone Repeaters" pre-

sented before the American Institute of Electrical Engineers on Oct. 1, 1919. During the year considerable improvements in this type of circuit have been effected, particularly with regard to its use on circuits composited for superimposed telegraph.

Toll Cables—Four-Wire Circuit.—During the year the principal difficulties remaining as a bar to the use of very long loaded toll cables have been removed and many miles of this type of cable have been installed. Most of this cable has been in locations where it forms the initial links in the cable network intended ultimately to provide an all-cable system connecting the principal cities of the United States. Much of the cable installed has been of the type designed to employ the four-wire circuit arrangement described in the Institute paper above referred to. The type of construction employed



FRONT VIEW OF TWO-WIRE VACUUM REPEATER RACKS

requires four loaded conductors of small gage for each telephone circuit, and has been found to have many very decided advantages over the two-wire cable circuit for certain conditions. It is expected that very considerable additions to the ultimate long-distance cable network will be installed during the forthcoming year.

Carrier Current Multiplex Telephony.—In the latter part of 1918 announcement was made of the successful commercial operation between Baltimore and Pittsburgh of a carrier current system of telephony which in that particular installation provided for four telephone circuits on each pair of wires in addition to the ordinary metallic circuit. Further installations of the improved apparatus have been engineered and are under way and still others are projected. While this stystem offers great possibilities in some directions, it has inherent limitations which will restrict its use to particular conditions.

NEW TELEPHONE CABLE FROM HAVANA TO KEY WEST

During 1919 the engineers of the Bell system completed the development work on a telephone cable from Havana, Cuba, to Key West, Florida. The problems involved in this cable were extremely difficult of solution, due not only to the distance and the depth of the water existing in the Florida Straits but also to the fact that it was desired to provide a link sufficiently good so that the universal service of the United States could be extended to include Cuba. In addition to the purely physical aspects of the case, the relatively small amount of traffic made it necessary to secure a solution that did not involve unwarranted expenditures, either in first cost or future maintenance. Following the successful solution of the problem plans were immediately undertaken by the American Telephone & Telegraph Company and the Cuban Telephone Company to obtain and lay one or more telephone cables across the Florida Straits at this point.

During the year many extensive telephone cable networks have been projected in different European countries—in particular, England, France, Sweden and Holland — and some work, notably, the Amsterdam-Rotterdam cable, is already under way. All of these projected systems are to employ methods developed and already in use in the United States.

The present situation throughout the world is one involving a very large shortage in submarine cable facilities. The situation is particularly acute in the United States, where at the present time we have not sufficient cable facilities to conduct our world communication in satisfactory fashion and where also we have no present domestic facilities for supplying our own needs. As is well known, the submarine cable industry has for years been essentially in the hands of British manufacturers. The need for new cables for extensions and repairs to British systems is such as to tax the facilities of the English cable factories for a number of years to come.

Under the conditions existing the Western Electric Company, Inc., decided in the past year to erect a large submarine cable factory, and the work on the plans for this factory, which is to be located on deep water at Norfolk, Va., is being pushed with the hope that by the end of 1920 there will be in operation in the United States a source of supply for such submarine cables as may be required by our communication systems.

PROGRESS IN TELEGRAPHY

No advances of a radically new kind in telegraphic methods have been announced during the year. The period has been, however, one of considerable readjustment in plant to accommodate a great increase in traffic. Also there have been some interesting improvements in certain of the mechanisms employed for printing telegraph service.

At the time announcement was made in 1918 of carrier current telephony, mentioned above, the fact that this same general system was also available for telegraph purposes was set forth. During the year a great deal of work has been done and an additional large installation of carrier current of telegraphy has been made. Numer-

ous other installations are being engineered and installed. Within its field and under proper conditions it bids fair to come into general use. The telegraph channels provided by this system can be employed for any of the purposes and with any of the terminal methods now in operation.

IMPORTANT RADIO DEVELOPMENTS

Radio-Telegraphy.—The outstanding events of 1919 in the radio field have been the completion of numerous large long-distance stations undertaken during the war and the paper by E. F. W. Alexanderson before the American Institute of Electrical Engineers on Oct. 1 in which was described the high-power alternator and its attendant system for rapid long-distance and semi-directive radio-telegraphy. In the United States as well as in foreign countries the situation in the entire radio field is unsatisfactory owing to uncertainty as to the ultimate national and international legislation designed to control this phase of electrical communication.

Radio-Telephony.—During the war great progress in radio-telephony, particularly in short-range radio-telephony, was made. During 1919 the developments which started in the preceding two or three years were carried on vigorously with a view to determining the extent to which radio-telephony was commercially available for service either alone or in conjunction with wire telephony. This work has tended to demonstrate the feasibility of commercial radio-telephony as a supplement to wire systems where natural conditions preclude the use of wires.

Goniometry.—Probably one of the most important developments in the radio field during 1919 was the establishment by the United States Navy of a considerable number of stations adjacent to the principal harbors designed to provide ships at sea with a statement of their exact position at any given instant. While these installations have not been completed and while the system has not been reduced to its final form, it bids fair to be one of the most valuable adjuncts yet devised for the safeguarding of navigation at sea.

RESEARCH WORK IS KEY TO PROGRESS

The fact that practically all of the important developments of 1919 and the two or three years immediately preceding it were the result of intensive research has enhanced still further the importance of this already important branch of the electrical communication business. Innumerable researches and developments in telephony and telegraphy, both wire and radio, are under way, and an increasing staff of highly trained scientists are directing their efforts to the solution of the problems intended to extend and better the service in these fields. The year 1920 should see some very marked improvements even though no startling new system is developed.

The results which have followed from the researches made on and with the devices that have grown out of the improved De Forest audion indicate that in this instrument electrical engineers and scientists have a most potent tool for advancing the art not only in the communication field but elsewhere. While many new and important uses employing the principles involved in the audion have been developed, the limits to the extent of its applicability are not yet in sight. It is probable that at no time in the world's history have so many physicists been engaged in a single piece of work as are now involved in the study of thermionic problems.

Maintenance of Interior Lighting Systems

Some One Should Always Be Responsible for Cleaning Lamps, Reflectors, Walls and Ceiling —Case Is Cited Where Illumination Was Raised from 2.7 to 7 Foot-candles by Simple Expedients

BY WARD HARRISON AND J. R. COLVILLE
Engineering Department National Lamp Works, Cleveland, Ohio

DIRTY reflectors, walls and ceilings darkened by smoke and dust, blackened lamps left in service as long as they continue to burn, empty sockets, unobserved burn-outs and replacements with lamps of wrong size or improper voltage rating are prime causes of inadequate illumination.

An office lighting installation recently examined is a case in point. The installation consisted of indirect units and had been in operation two and one-half years. The ceiling had been painted a flat white and the walls finished in a light buff. At the time the installation was made the intensity of illumination was adequate.

The engineer who investigated this installation, in response to a complaint, found that the average illumination intensity on the desk tops was 2.7 foot-candles—unquestionably too low for office work.

(1) The reflectors had been wiped out at fairly regular intervals, but were nevertheless taken down and thoroughly washed. The illumination jumped at once to 3.7 foot-candles—an increase of over 35 per cent arising from washing what appeared to be fairly clean reflectors.

(2) The lamps had been in service for more than two years. Furthermore, it was found that their rating was several volts higher than the average voltage of the circuit. When new lamps of the proper voltage rating were substituted the illumination increased to over 5 foot-candles.

(3) The ceiling in this office had originally been finished with a paint which had been tested and found to reflect 75 per cent of the light striking it. In two and one-half years it had become so soiled through soft-coal smoke that a comparison with paint samples whose reflection factors were known demonstrated that it was reflecting but 50 to 55 per cent of the incident light. The side walls had depreciated in like proportion. Refinishing the office in its original tone further increased the illumination by about 40 per cent, or to a total of over 7 foot-candles.

Here is a case where failure to observe simple main-

tenance requirements resulted in an intensity of 2.7 foot-candles where an intensity of over 7 was being paid fo"

There are two methods by which the maintenance of any selected value of intensity can be assured—first, by allowing for an enormous depreciation in the light and consequently using much larger lamps than would ordinarily be considered necessary; second, by maintaining the system properly and allowing for reasonable depreciation. The second, or generally practical, method involves:

1. The use of a depreciation factor, or factor of safety, in the original design of the system to insure adequate illumination when the system has depreciated a normal amount.

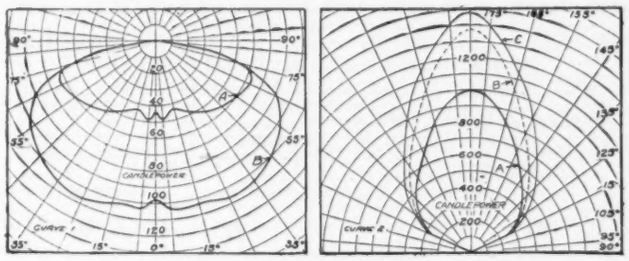


FIG. 1—DIRT DESTROYS THE EFFECTIVENESS OF LIGHTING EQUIPMENT

A—Reflector dirty.
B—Reflector clean.
A—Reflector dirty.
B—Reflector wiped out.
C—Reflector washed.

2. The cleaning of lighting units at frequent, regular intervals.

3. The replacement of lamps which have become blackened in service by abnormally long life.

4. The use of lamps of the correct voltage rating for all replacements.

5. The refinishing of ceilings and walls at reasonable intervals.

THE DEPRECIATION FACTOR IN ILLUMINATION DESIGN

The purpose of the depreciation factor is to insure adequate illumination when the installation shows maximum depreciation under the system of cleaning adopted. For example, where units are cleaned and inspected every three weeks the illumination just before cleaning may be 15 per cent lower than immediately after. Furthermore, the ceiling and walls will gradually become darkened, so that the illumination at the end of a year, even with the lighting units thoroughly cleaned and the lamps in excellent condition, will be materially lower than when the installation was new. In order to insure that the illumination will at no time be inadequate, it is necessary to add a suitable amount to the intensity considered desirable and design for this larger amount initially.

How dust and dirt destroy the effectiveness of lighting units is strikingly shown in Fig. 1. A point which is not apparent from the curves but which should be mentioned in this connection is that a dirty installation is likely to be more objectionable from the standpoints of glare and density of shadows than one which is clean. Glare is somewhat a matter of brightness contrast, and a bright bulb against a dirty reflector or a bright unit against a blackened ceiling may appreciably accentuate glare. The density of shadows depends, among other things, upon the areas of the light sources, and where reflectors are dirty, their contribution of diffused light is lost and dark, sharp shadows result.

How large an amount should be added to the intensity considered adequate, or, what amounts to the same thing, by how large a factor the intensity considered adequate should be multiplied, to insure proper illumination at all times, depends upon the specific conditions surrounding any particular installation. The data presented in Table I, taken from the lecture course presented in 1916 under the joint auspices of the Illuminating Engineering Society and the University of Pennsylvania, give specific figures for depreciation due to dirty lamps and reflectors. In general, when installed in relatively favorable locations, open-reflector units show a depreciation which ranges from 10 to 25

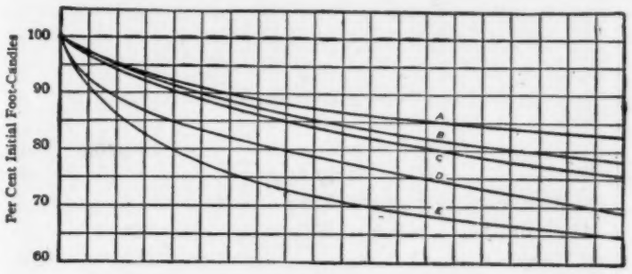


FIG. 2—EFFECT OF COLLECTION OF DUST ON LAMPS AND REFLECTORS

A—Dome enameled steel.
B—Bowl enameled steel.
C—Dense opal glass.
D—Prismatic glass.
E—Light-density opal glass.

per cent in four weeks' time. Where excessive smoke and dust are the rule, the depreciation over the same period may be as high as 40 per cent. The depreciation of ceilings and walls depends not only upon the characteristics of the location—*i.e.*, whether clean or dirty—but upon their original color as well. The only factor which is not affected by location is the depreciation of lamps with burning. Gas-filled lamps average about 95 per cent of their initial light output throughout life;

TABLE I—LOSS OF LIGHT BY ACCUMULATION OF DIRT *

Authority and Reference	Conditions and Surroundings	Lamps, Globes and Reflectors	Period Covered by Tests	Per Cent Total Decline for Period
Durgin and Jackson *Trans.* I. E. S., 1915, p. 707.	Downtown Chicago Office building dustiest rooms.	Semi-indirect dense bowls and tungsten lamps.	Three weeks	26
Aldrich and Malia, *Trans.* I. E. S., 1914, p. 112.	Office building in Chicago stock yards.	Prismatic reflectors, satin finish, and tungsten lamps direct.	Twelve weeks	25
Aldrich and Malia, *Trans.* I. E. S., 1914, p. 112.	Office building in Chicago stock yards.	Mirror reflectors and tungsten lamps indirect.	Nine weeks	25
Edwards and Harrison *Trans.* I. E. S., 1914, p. 176.	Office corridor suburban district, Cleveland.	Inclosing prismatic.	Eight weeks	11

* "Illuminating Engineering Practice," 1916, Illuminating Engineering Society—University of Pennsylvania.

the output at the end of rated life is usually about 92 per cent of the initial output, and where there are only one or two lamps in a room lamp depreciation must be based upon this figure rather than upon the average output. While the total depreciation of lighting systems over a given period will, of course, vary widely,

experience has shown that a factor of 1.2 for very clean locations and very clean operations (16⅔ per cent loss) and a factor of 1.5 for dirty locations and relatively dirty operations (33⅓ per cent loss) may be used with assurance of satisfactory results, provided, and this is of the greatest importance, that a schedule of regular and frequent cleaning be adopted and adhered to.

THE DIFFERENT PHASES OF MAINTENANCE

Cleaning.—The curves of Fig. 2 are of interest as showing the relative rapidity with which various systems of open-reflector units depreciate owing to dust and dirt. The values from which these curves are plotted were obtained by measuring the illumination intensity at the work. In this way the effect on the resulting illumination of deposits on the inside and the outside of the reflecting and diffusing surfaces is correctly weighted, a result not obtained when units are measured in a photometer for total light output.

FIG. 3—FOOT-CANDLE METER

Reference to curve 2 of Fig. 1 will show that there is a great difference between merely wiping out a unit and washing it thoroughly. On the average, wiping out has about two-thirds the effect of a thorough washing. Obviously, in arriving at any cleaning schedule, the care with which the work is to be done is an important consideration.

A device has recently been developed which will be found extremely useful in the proper maintenance of a lighting installation. This device is known as a foot-candle meter, for it measures the illumination at the work directly in terms of foot-candles. The instrument is shown in Fig. 3. With it the illumination can be read directly from the scale without computations or adjustments. In one large establishment where the superintendent uses a foot-candle meter systematically as a check on his maintenance department, readings of illumination intensity are taken at regular intervals at fixed stations throughout the plant. These readings are recorded in such a way that the successive readings are readily comparable. When any inconsistency appears in the records an investigation is made and the proper remedy applied. The intensity in this establishment is never allowed to fall below 6 foot-candles without immediate correction. By measuring light actually delivered to the work the foot-candle meter automatically reveals the combined effect of all possible causes of depreciation. Ignorance of the magnitude of depreciation has often been the cause of inadequate maintenance.

As has been pointed out, the importance of the factors affecting the rate of depreciation of a lighting system is largely dependent upon local conditions, and it is difficult to formulate cleaning schedules which will be generally applicable. The schedules suggested in Table II may be used as a basis for formulating a schedule adapted to specific conditions; however, a man with a foot-candle meter is the best judge of individual requirements.

It is of the utmost importance that the responsibility for proper maintenance of the lighting system be definitely assigned. Experience proves that unless there is a clear understanding on this point the work is never properly handled. A definite schedule should be outlined and carefully enforced. In large industrial plants, large office buildings and the like a small maintenance department is necessary for accomplishing effective results. In smaller buildings one employee may be able to handle the work satisfactorily. It is significant that several of the more progressive window-cleaning companies have established the cleaning of lighting equipment as a part of their regular service, and this plan has the advantage that the work is done by trained men.

TABLE II—SUGGESTED CLEANING SCHEDULES

Where direct-lighting systems are used—i.e., where there are no reflecting or diffusing surfaces concave upward to invite dirt accumulation—the interval of cleaning should be about as follows:

Characteristic of Location	Interval in Days if Units Are Wiped Out*	Interval in Days if Units Are Thoroughly Washed
Very dirty	3	5
Dirty	7	10
Average	15	20
Clean	30	40

Where open semi-indirect or totally indirect units are used:

Characteristic of Location	Interval in Days if Units Are Wiped Out*	Interval in Days if Units Are Thoroughly Washed
Dirty	5	7
Average	10	15
Clean	20	30

* Washing every third or fourth interval assumed.

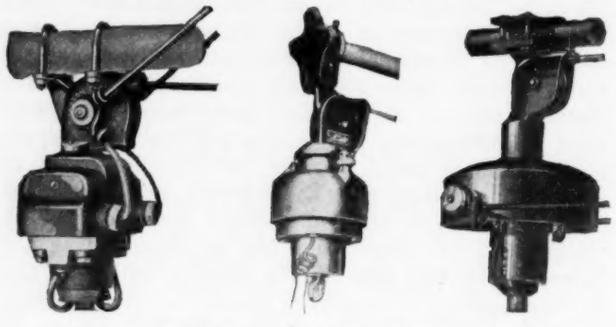


FIG. 4—CUT-OUT HANGERS FACILITATE CLEANING

It is unfortunate that in the design of lighting systems more attention is not given to accessibility for cleaning. Yet even where careful thought is given to this factor it is frequently necessary because of other considerations to place units where they are very difficult of access. In many industrial plants, such, for

example, as steel mills, units can be reached for cleaning only from the traveling crane, and the fact that the crane is likely to be in service twenty-four hours a day six days in the week complicates the maintenance problem. Where such conditions exist, it is advisable to go over the system every week end rather than to attempt to operate a five-day or a ten-day cleaning schedule. In some cases it will be found practicable to

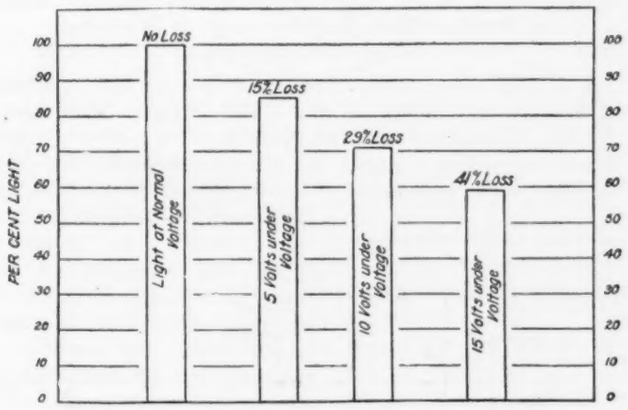


FIG. 5—LOSS OF LIGHT DUE TO LOW VOLTAGE
Based on 115-volt tungsten lamp

substitute clean units for dirty ones throughout a section of a plant, clean the dirty ones, and substitute them for others in another section, etc. This can be done readily by using standard devices for connecting to and disconnecting from the circuit.

Where units are so placed that their proper maintenance involves considerable difficulty or perhaps danger to the one who looks after them, the investment in some form of disconnecting hanger which permits the units to be lowered to the floor is advisable. Several types of such hangers are available and their use will be found to go a long way toward insuring proper maintenance. Women, or men who are no longer able to work safely high above floor level can sometimes be employed advantageously where the work is simplified in this way.

Some units are, of course, easier to clean than others, but, with the exception of certain types built up of plaster* or composition and those employing polished metal, all require a thorough washing at least as often as every third or fourth cleaning period. A small stiff brush will often be found to expedite the work. Warm water and soap appear to be about as effective as the chemical cleaners for general use, although where the reflectors become stained, as by exposure to fumes, the latter facilitate the work. Any prepared cleaners which give satisfactory results in the bathroom of a home may be used without fear of their damaging the reflecting surfaces of lighting units. Where mirrored reflectors are washed, special attention should be given to avoiding injury to the backing.

Replacement of Lamps.—The manufacturers, through improvements in lamp making, have succeeded in producing lamps in which the candlepower is well maintained throughout life, and blackened bulbs are continually decreasing in number. However, individual lamps show considerable variation from the average performance, and where inspection shows a bulb to be considerably darkened the lamp should be replaced with a new one. Vacuum lamps require more careful inspection in this respect than gas-filled lamps.

While it can be shown that it is cheaper to replace a blackened lamp with a new one under most operating conditions, the consideration of greater importance is the fact that blackened bulbs absorb light which is needed upon the desk tops, machines or counters, as the case may be. The inspection of lamps for this cause of lighting depreciation is simple, and it should be done at each cleaning period.

The cleaning of any unit should not be considered complete until it has been lighted to insure that the lamp or lamps operate. Where several lamps are used in an indirect or dense semi-indirect bowl, one or more may fail without the effect in the illumination being at once apparent unless the maintenance man examines the fixture for this possibility. On the other hand, where a single large lamp is used in such bowls a lamp failure is at once observed. The cleaners should carry a supply of lamps of the proper size with them so that a burned-out bulb may be replaced immediately.

Voltage Rating.—Incandescent electric lamps are rated for a given light output at a certain voltage. On a lower voltage a lamp will give less light and on a higher voltage more light. This is generally understood, but few appreciate that the variation in light output is several times as great as the variation in voltage. The chart of Fig. 5 shows the relation between light output and voltage as obtained by exhaustive tests on many groups of lamps. A difference between rated voltage and operating voltage of a few per cent is accompanied by a percentage difference in light output about three and a half times as great.

Refinishing of Ceiling and Walls.—How frequently an interior requires refinishing depends upon: the type of

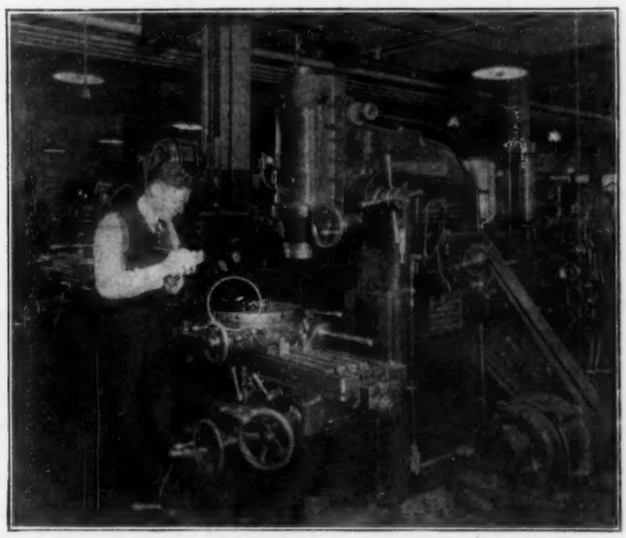


FIG. 6—FOOT-CANDLE METER REVEALS POSSIBLE CAUSES OF DEPRECIATION

lighting, whether direct, semi-indirect or totally indirect; the nature of the finish employed; the characteristics of the location, whether relatively clean or dirty, and, in less degree, upon the color of the finished surfaces.

Reflectors in a direct-lighting system themselves turn light into a downward direction and make the effectiveness of the system less dependent upon reflection from

*The reflecting efficiency of plaster or composition can best be renewed by rubbing with sandpaper or a stiff wire brush.

the ceiling and walls than where other units are used. Inclosing units amid light-colored surroundings produce a distinctly pleasant brightness; amid dark surroundings they furnish much less light and frequently are excessively glaring. Again, semi-indirect and totally indirect systems depend essentially upon good reflection from the ceiling, and to a less extent from the walls, for their effectiveness.

Fortunately, considerations of appearance often dictate the refinishing of a soiled and gloomy interior where the expenditure from a lighting standpoint alone would not have suggested itself. However, ceilings and walls, like other reflecting surfaces, lose much of their effectiveness before the accumulation of dust has reached the point where the surfaces appear badly in need of refinishing. For this reason it should be the duty of the maintenance department to ascertain the condition of the walls and ceiling and to see that they are kept in a good reflecting condition.

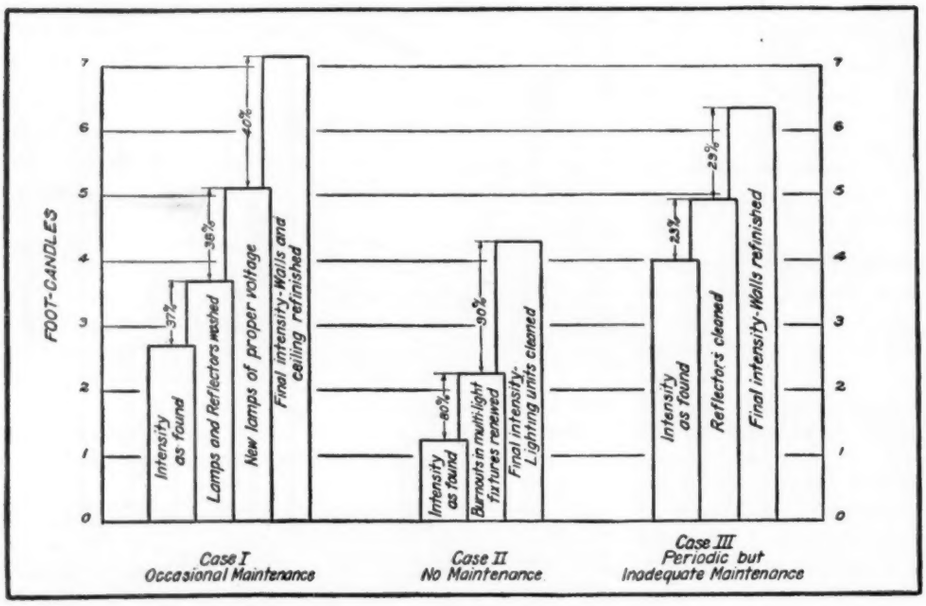


FIG. 7—TESTS OF SEMI-INDIRECT AND INDIRECT LIGHTING SYSTEMS ILLUSTRATE NECESSITY FOR REGULAR AND ADEQUATE MAINTENANCE

CONSIDERATIONS IN CHOICE OF COLORS

A white paint or plaster surface absorbs less light than any other interior finish. Yellowish or warm-toned paints are considered desirable in many cases on account of the cheerful, pleasant atmosphere created. Such tones reflect a larger proportion of artificial light striking them than blue tones, although the latter may appear at first glance equally light. The reason for this is that the light from the ordinary incandescent lamp contains a higher percentage of yellow and red rays than blue rays, and a surface of a tone other than white reflects a greater proportion of the rays of its own color than of another color. This is the basis of the common recommendation that where a white paint is not wanted a paint of light-cream tone may be used without bringing about a marked sacrifice ir lighting effectiveness.

The mistake should not be made of using paints of a yellowish tone for ceilings with daylight lamps in indirect or semi-indirect fixtures, for the yellow tones would not only reduce the efficiency of the installation but would destroy largely the daylight effect sought. Experiments have shown, however, that the color of the portions of the side wall near the floor has no material effect upon either the color quality or the amount of illumination.

POSSIBILITIES OF ELECTRIC SMELTING IN FAR WEST

Low Energy Rates, Ore Deposits and Smaller Bulk of Product Give It Advantage in Smelting Ferro-Manganese

AT THE present time there are five plants smelting ferro-manganese on the Pacific Coast. The possibilities of success and the growth of the industry are based upon the chances for cheap power, as the cost of the power consumed is a very great proportion of the manufacturing cost. This may readily be realized when the consumption of from 600 kw.-hr. to 800 kw.-hr. per ton of steel is compared with the necessary consumption of from 7,000 kw.-hr. to 9,000 kw.-hr. per ton of metal in the production of ferro-silicon. Moreover, electric furnace steel sells for a higher price per ton than any of the ferro-metals. The presence of ore deposits in this region and the smaller bulk of the finished product give the West an advantage in freight rates. It has been stated by the industry that if power could be obtained at $18 per ton per kilowatt-hour per year the West might readily compete in the market.

It has been found that a three-electrode furnace is most efficient, and about 60 per cent of those in use are three-phase. The lower contact in a one-phase furnace gives trouble by burning off and letting the metal through the furnace. There is danger of an excess carbonization of the bath with two electrodes. The power factor of the induction furnace is low and losses from radiation are high. It has been found that the electrode loss of a three-phase furnace is about 8 per cent. Best results are achieved at a voltage of from 60 to 70, a higher voltage resulting in too much volatilization.

Electrodes may be made at the factory from calcined anthracite coal from which all the volatile material is driven and which is then ground fine and mixed with from 15 to 20 per cent of pitch of not too hard a consistency. The electrode is then pressed into shape and again calcined. A socket and pin joint makes it possible to conserve electrodes by attaching the new to the stub of the old.

The process of smelting goes on almost continuously, as the furnaces are fed from the top and tapped from the bottom without disturbance of the electric regulation. The load factor runs 95 per cent or better on 25 cycles and the power factor averages 95 or 96 per cent.

Present and Future of Line Insulators

Expansion of Metal Parts, Cement, Etc., Cause of Failure — Combined Electrical, Mechanical and Porosity Test Should Be Substituted for Present Tests —Value of Grading High-Voltage Strings

BY F. W. PEEK, JR.
General Electric Company

AFTER a few years of more or less successful operation, insulators selected by the most careful or most severe electrical tests begin to fail rapidly. There are, of course, exceptions, but this has been the general experience.

The apparent deterioration of the porcelain is for the greater part due to one or the other of the following causes:

1. Gradual mechanical cracking due to the expansion of cement or tight-fitting metal parts, to internal strains caused by firing or to brittle porcelain.

2. Gradual absorption of moisture due to porous porcelain.

The greater part of the trouble has been due to cracking. Failure of porcelain insulators where tight-fitting or tightly cemented-in metal parts are used is not surprising when the poor mechanical characteristics of porcelain are considered. Cracks gradually develop under the mechanical stresses and are finally followed by electrical failure at the weakened parts.

The foregoing causes of deterioration are pretty well verified in practice because the types of insulators in which the porcelain units are strung together by loose fitting metal parts or cables have not failed. For instance, operating reports and electrical and mechanical tests made on one type of non-cemented insulator show no deterioration after ten years of service.

It has been suggested many times that porcelain be replaced by a more suitable material. Unfortunately no such material is available at the present time. Until such a material is developed porcelain should naturally be used to the best advantage.

PRESENT ELECTRICAL TESTS NOT CONCLUSIVE

Practical experience has shown that the most severe electrical tests do not solve the problem, but, on the contrary, may do a great deal of harm. Experience has also shown that an insulator mechanically constructed to avoid expansion and porosity troubles may survive even if made of inferior porcelain. High-voltage electrical tests made at the factory cannot be expected to anticipate mechanical failure due to expansion of metal parts or to the absorption of moisture after several years of service.

The solution seems to be to start with an insulator designed to avoid any possible cracking of the porcelain parts from expansion of cement or metal. Years of service have so far been the best criterion of design. The material should then be selected of uniform quality, reasonable toughness and freedom from porosity and firing strains. The terms "tough" and "non-porous" are relative terms, and the allowable safe variation will depend to some extend on the design. The electrical strength of the completed unit should, of course, be reasonable, but this is really secondary to the other characteristics, since the highest electrical strength vanishes when a crack appears.

The ends mentioned cannot be attained by applying excessive electrical tests to anticipate future cracking which is due to firing strains or brittle porcelain. The results can best be attained by testing a small percentage of the product to destruction from day to day after the usual electrical and inspection tests have been made, the object being to determine if the product is up to the standard and of uniform quality. Electrical, mechanical and porosity uniformity tests are necessary. Extremely accurate tests are not important, but it is important to have tests that can be very quickly made, in order to be able to find at once any trouble due to firing or poor materials. A check test should be made on the firing indicated as unsatisfactory by the uniformity test. If the repeat tests still show the material to be unsatisfactory either electrically or mechanically, or to be porous, the complete firing should be rejected. Such tests will insure a uniform product and success on a tried design, but will not of course correct a poor design.

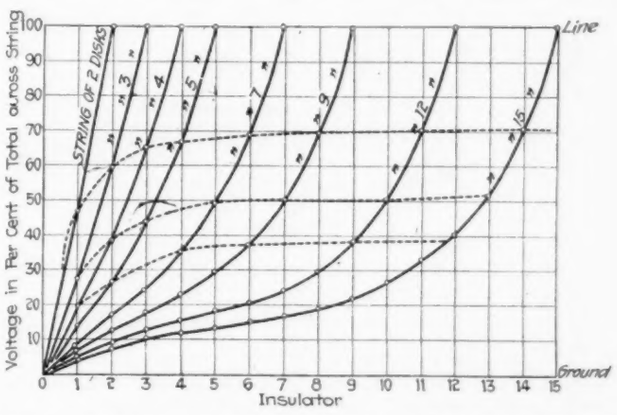


FIG. 1—VOLTAGE DISTRIBUTION ACROSS INSULATOR STRINGS OF TWO TO FIFTEEN DISKS (UNGRADED)

UNEVEN VOLTAGE DISTRIBUTION ACROSS INSULATOR STRINGS

It is interesting to discuss at the prseent time the relative reliability of insulators for different line voltages and what changes from present practice, if any, are necessary for the very high voltages which are now being proposed. On low-voltage lines where only one unit is used the breakdown of that unit means a failure. At a somewhat higher voltage where two units are used the chances of complete failure at a given point are less, since one good unit will withstand line voltage and the probability of both units failing at once is small. The probable complete failure of a string decreases as the number of units in the string are increased.

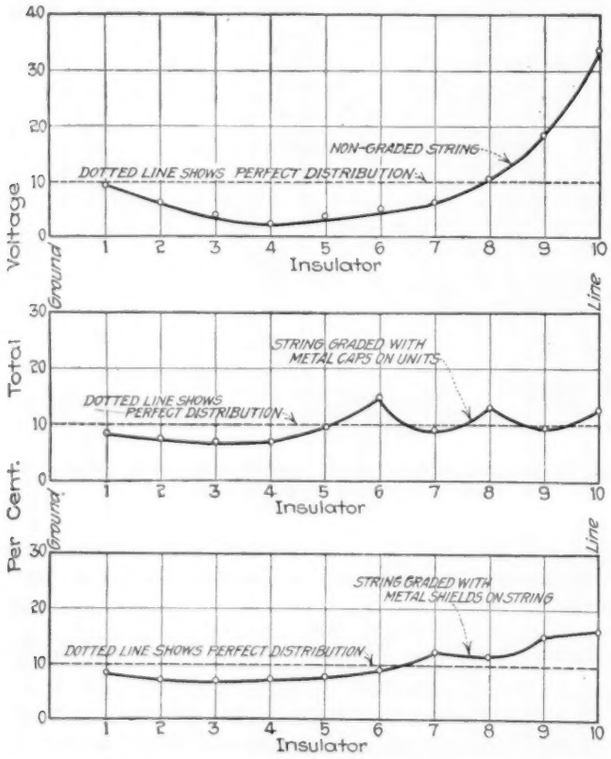
The percentage of failures due to cloud lightning should decrease with increasing line insulation and, therefore, with increasing line voltage. This follows

because for any given number of lightning storms there are many low-voltage surges, a less number of moderate-voltage surges and few extremely high-voltage surges induced on a transmission line. Both high-voltage and low-voltage lines are subjected to practically the same disturbances.

There is one factor of increasing importance with increasing voltage.[1] It has long been known that when insulators are placed in series in a string the arc-over voltage is not the sum of the arc-over voltages of the individual units, but much less. This is due to the uneven division of voltage on the different units. A very high percentage of the voltage is across the line unit. Typical curves for voltage distribution on strings of insulators of from two to fifteen units in length are given in Fig. 1.

GRADING IS HELPFUL ON HIGH-VOLTAGE STRINGS

It will be noted that for strings of from five to fifteen units approximately 30 per cent of the operating voltage is across the line unit. This is not especially serious for the lower voltages. For instance, at 100 kv. the voltage to neutral is 58 kv. and the voltage across the line unit is $0.30 \times 58 = 17.4$ kv., but for a 220-kv. line the voltage across the line unit is $(220 \div 1.73) \times 0.30 = 38$ kv., which is higher than desirable.



FIGS. 2, 3 AND 4—VOLTAGE DISTRIBUTION ACROSS SIMILAR STRINGS OF INSULATORS EXCEPT THAT ONE IS UNGRADED WHILE TWO ARE GRADED

The uneven distribution of voltage is due to the capacity to ground. The insulator next to the line must carry the ground capacity current of all the other units whereas the second unit from the line must carry the capacity of all the units but one, etc. The distribution can, therefore, be corrected by increasing the capacity of the units near the line or by using plates or shields, especially on the line end. Figs. 2, 3 and 4 show the voltage distribution on a string of ten units. Perfect distribution is represented by the dotted line. It is unnecessary to get perfect distribution in practice; it is probably preferable to grade in steps to avoid too many parts. Figs. 3 and 4 show actual step-grading curves on the same string. In Fig. 3 the capacity of the units near the line was increased by variable metal caps, in Fig. 4 by a ground shield. Perfect grading can readily be obtained in the laboratory. In these strings grading was accomplished by very few steps.

On the non-graded string of insulators above it would be expected that the arc-over voltage would be $1/0.30 = 3.3$ times the arc-over voltage of one unit, since the line unit would be at arc-over voltage if the above voltage were applied to the string. As a matter of fact it is much higher, because the conducting corona which first forms on the line units in effect increases the size of the caps and automatically grades and reduces the stress on the line unit as the arc-over voltage is approached.

RELATIONS OF WET AND DRY ARC-OVER VOLTAGES

Heretofore the main argument given for grading has been to reduce the string length by increasing the arc-over voltage for a given number of units. It is much more important to reduce the operating stress on the line-end units.

With certain types of units the wet arc-over voltage may be higher than the dry arc-over voltage for long strings.[2] This is because rain may assist in grading a badly unbalanced string. As a general rule, a string cannot be very greatly shortened in practice by grading because of the effects of rain, dirt, etc., on the perfectly graded string. There would be little gain in increasing the dry arc-over voltage if at the same time the wet arc-over voltage were decreased. Rain would not increase the arc-over voltage of a graded string. The wet arc-over voltage would generally be lower because of the decreased length of string.

It has been found that the lightning arc-over voltage may be relatively greater on the non-graded string than on the graded string and that the wet lightning arc-over voltage is usually as high as the dry lightning arc-over voltage.[3] The lightning arc-over voltage is to a great extent a question of string length.

The wet and dry arc-over voltage of insulators decreases almost directly with barometric pressure. The insulator problem for the extremely high voltages is therefore more difficult at the higher altitudes.

From the above discussion it may be concluded that:

Insulator troubles have been due mainly to cracking caused by expansion of metal parts, cement, etc., and to porosity.

Certain designs with loose-fitting parts have been free from deterioration.

The old method of basing all on the electrical test should be abandoned. Severe electrical tests are often harmful. The electrical strength is secondary to other characteristics. An electrical, mechanical and porosity uniformity test should be established in which a small percentage of the product is tested to destruction from day to day. If it is running porous or brittle or is weakened by firing strains, it should be rejected.

[1] Peek, "Electrical Characteristics of the Suspension Insulator," *A. I. E. E. Transactions* 1912, Vol. XXXI, page 907.

[2] Peek, "Electrical Characteristics of the Suspension Insulator," *A. I. E. E. Transactions*, 1912, Vol. XXXI, page 902.

[3] Peek, "The Effect of Transient Voltages on Dielectrics," *A. I. E. E. Transactions*, 1915, Vol. XXXLV, page 1857. "Factors Determining the Safe Spark-Over Voltage of Insulators and Bushings," *G. E. Review*, June, 1916.

For the very high voltages that are at present being considered greater reliability may in some respects be anticipated. The lightning arc-over voltage will be relatively higher and induced lightning voltages sufficient to cause arc-over will be less than on the low-voltage lines. Increasing the number of units in series is an advantage. Uneven distribution of voltage on the string becomes more serious on the higher voltages because of the high stress on the unit near the line. For strings of more than four or five units this stress is practically a constant percentage of the operating voltage independent of the string length. Uneven distribution can be corrected by grading. It will also often be found necessary at the very high voltages to use shields to prevent excessive corona on the line-end units.

What the Goodwin Plan Is Accomplishing—II

How the New Trade Spirit of Co-operation and Recognition of Service Rendered by Retailers, as Advocated by the Goodwin Plan, Is Being Reflected in the Business, Profits and Functioning of All Trade Groups

BY O. H. CALDWELL
Editor *Electrical Merchandising*

IN THE section of this article which appeared in last week's issue the benefits from the Goodwin Plan already apparent to central stations were summarized. Paralleling these benefits in importance to the entire industry are those resulting from the re-creation of the electrical contractor into the "contractor-dealer." The new spirit of co-operation in the trade has been built up from the fundamentals, by establishing the service function of the installer of wiring and the retailer of electrical goods. With this service function acknowledged and supported by manufacturers and jobbers, electrical contractors everywhere are being encouraged to open new retail stores, improve existing stores and render the kind of service that the buying public and the electrical industry expect of them. Where co-operation of the central station has been added, the old-time destructive competition has vanished and a true spirit of "service first" to the customer has taken its place.

Contractor-dealer organizations, local and national, have been strengthened all over the country and are to-day operating actively, developing ideas for better business among their members and elevating the business standards of the retail electrical trade.

Hundreds of contractor-dealers have installed standard accounting systems, cost-keeping methods and regular inventories of stock, so that they now know exactly the status of their business at any time. This is resulting in fewer business failures, and contractor-dealers everywhere are becoming better credit risks on the books of the manufacturers and jobbers.

Contractor-dealers are benefiting from the helpful attitude of electrical jobbers, many of whom have instructed their salesmen first of all to help their contractor customers to become better business men, to display their merchandise attractively, to equip and maintain their stores in keeping with the best in retail practice, and to run a good set of accounts. In other words, the jobber's salesman to-day is encouraged to be a merchandising instructor rather than an order taker. As a result the contractor-dealers are doing more business and the salesmen are getting bigger orders than ever before.

How the Jobber Has Benefited

Increased volume and new lines of electrical goods handled, resulting in a reduction in the percentage of overhead and an increase in net earnings, are among the benefits now coming to the jobber.

In addition, the position of the jobber in the distribution plans of the manufacturer has been strengthened and his status as the most economical distributer more firmly established than ever. Among both manufacturers and dealers a more appreciative understanding is being created of the definite service rendered by the jobber and the reasons why he should receive an adequate jobber's compensation.

Many new members have joined the Electrical Supply Jobbers' Association, strengthening that association and making better association members of those already affiliated.

Jobbers everywhere have benefited from the increasing tendency of contractor-dealers to buy locally instead of buying from houses outside their own territory, which give no service.

Jobbers all over the country report an improved credit situation on the part of their contractor-dealer customers. Three years ago the contractor-dealer was generally an unfavorable credit risk; to-day his credit rating is generally "good." Hundreds of new retail merchants and contractor-dealers have come into the industry, and these all become customers of the jobber. In addition, electrical jobbers are now handling and distributing—at a saving—products of a number of the manufacturers who formerly marketed their products direct to retailers.

The Jobbers' Association has been shown the advantages of publicity and has for the past year conducted an advertising campaign telling frankly before the electrical trade its story of the jobbers' service as an indispensable economic factor. And not only are the jobbers advertising collectively as an association but a great stimulus has been given to advertising and publicity work by individual jobbers. Many of these wholesale houses have begun aggressive campaigns, directed at their own present customers and to make new retailer customers.

The present movement has been responsible for numbers of jobbers giving up the retail end of their business, which they formerly thought profitable but which upon investigation they have found to be a source of expense, in this way increasing their net earnings.

The jobbers' association has thrown open its own national meetings—enabling manufacturers, contractor-dealers and the trade press to be present and to gain a more comprehensive idea of the jobber's own problems.

As a result the contractor has obtained a comprehensive knowledge of the jobber's problems and is more sympathetic. Manufacturers who were indifferent are now seeking jobbers as distributers. The jobbers, on the other hand, are also attending local meetings of contractor associations and themselves learning more of the problems of the contractor-dealer and the reasons why many contractors were "poor credits" in the past.

MANUFACTURERS HAVE IMPROVED THEIR DISTRIBUTION

With the increase in the number of retail stores, operating on the new merchandising service basis, there has come to the manufacturers of electrical devices and supplies not only an increase in demand for their fast-moving lines but also a substantial increase in their established lines at a reduced selling expense.

Distributing through jobbers, electrical manufacturers to-day can predict their quotas better, for by obtaining definite commitments from jobbers the manufacturer is able to plan his production properly in advance and arrange his processes of manufacture in the most efficient way.

Manufacturers have been able to tap new territories, for with the establishment of hundreds of new retail outlets in communities never before reached by the electrical trade, electrical products are now finding an ever widening and increasing public. Moveover, there is the tendency for the manufacturer to produce a higher quality of merchandise than ever before, for discriminating purchasers are now demanding quality goods.

Problems of both the jobber and the contractor-dealer are being better understood by the manufacturing company, which is coming to appreciate the requirements of the trade as to quality and nature of product, methods of promotion and the proper discount schedules of various lines.

The public to-day is being informed regarding the labor-saving convenience values of electrical appliances by the sales efforts and individual publicity of thousands of retailers and wholesalers, in this way further stimulating the demand for the manufacturers' goods. It is undoubtedly this educational publicity, coupled with the tremendous increase in the number and effectiveness of retail outlets, that has contributed to the present tremendously expanded condition of the electrical appliance market, in which the manufacturers have been virtually swamped.

Manufacturers to-day are also coming to appreciate better the magnitude of the appliance and merchandising end of the electrical business, and to realize that there is tremendous business in the field of electrical appliances and labor-saving devices—business which exists in unlimited quantities.

THE NEW SERVICE TO THE PUBLIC

From the improved distribution of electrical goods resulting from the proper functioning of all trade groups, the public is being served rather than exploited. The marked increase in the sales of electrically operated labor-saving devices is only one illustration of the readiness of the American public to adopt modern improvements in the home with the same consideration for economies and convenience as when adopting them in the office and the factory. This increase in the volume of appliance sales is helping to bring about economies in their production and marketing, resulting in more favorable prices to the public than could have been possible with restricted outputs and individual and direct sales efforts.

Furthermore, electrical appliances to-day have been made easier for the public to buy. The customer has no longer to hunt or to go out of his way to find an electric shop. New stores are being opened daily in ever increasing numbers where there are found not only complete stocks of electrical goods, electrical conveniences and electrical labor-saving devices, but a spirit of service and an eagerness to tell the story of the "electrical way." Where the central station has also adopted this spirit and told its customers that the misnamed "current-consuming device" is really a "labor-saving device," the expensive commercial department has been converted into one that pays its own way.

Lighting customers are no longer required to pay for lamps they do not use as they were under the so-called "free-renewal" plan, where the cost of lamps and renewals was actually added to the customer's bill as a kilowatt-hour charge. Eight hundred companies have already replaced this out-of-date "lamp-renewal" plan with a lamp sales policy worked out on a merchandising basis, and in those cities lamps can now be purchased in any electric shop.

Contractors, in explaining the possibilities of providing "100 per cent installations" to their customers, installing outlets for every possible appliance need, locating lighting for the best possible results and placing switches for the greatest convenience, are doing a real service in showing the customer how to get the best possible service from his electrical investment and from electricity.

Articles in the daily papers and the general and household magazines and the newspaper advertising by manufacturers, jobbers and dealers who have followed the new merchandising activity in the trade have thrown new light on electric service and helped the public to understand and use those appliances to which the application of the expression "labor-saving" has a real meaning.

This better understanding of electric service tends not only to make the American home of a family of moderate means more effectively lighted but creates a demand for a complete service, calling for a wiring installation planned for convenience and efficiency in doing housework through adequate outlets and provisions for the motor-operated and electrical heated devices which at small cost transform the kitchen and the laundry in keeping with the tastes and inclinations of the average housewife.

TAXES have to be paid by the public. They cannot be imposed on any class. There is no power that can prevent a distribution of the burden. The landlord may be the one who sends a check to the public treasury, but his tenants nevertheless make the payment. A great manufacturer may contribute a large share of his income, but still the money comes from the consumer. It is impossible to escape the conclusion that high taxes make high prices. So long as the cost of government is high the cost of living will be high.—*Calvin Coolidge, Governor of Massachusetts.*

Readers' Views and Comments

Need for the Measurement of Glare

To the Editor of the ELECTRICAL WORLD:

SIR: It has occurred to me that you might want to insert in your paper the fact that there is a need which is felt in the illuminating engineering field for glare measurement. Glare interferes with vision and, besides being the cause of eye strain, headache, etc., is also the cause of serious accidents. It is often of importance in connection with the industrial codes and other good lighting specifications to be able to designate a degree of glare as an upper limit in a measurable quantity. Some attempt has been made to describe such a limit in terms of equipment, but this does not seem practicable or equitable as between different types of lighting units and equipment.

The art and practice of lighting would be advanced very materially if we had a simple portable instrument comparable with a foot-candle meter which inspectors, engineers and others could use to measure and to assign at least approximately the degree of glare throughout the objectionable range encountered from any point of observation in a room lighted either naturally or artificially. There is a similar need, through perhaps different ranges, in connection with street lighting and railway or automobile headlighting. Such an instrument might be called a "glarometer," "diffusometer," "contrast meter" or "brilliancy meter," according to the principle that would be most practicable for ordinary convenience.

While Messrs. Nutting, Cobb and others have carried on considerable laboratory research regarding the elements of glare, there is still a need for further investigation, especially as regards the practical interpretation and application of the principles under actual installation conditions. Even after the general standards are established, there will be a need of a means by which a non-scientific inspector can assign values to the conditions as encountered in any particular room or installation.

As glare involves physical, physiological and perhaps psychological values, accurate determinations constitute a difficult laboratory problem. After a number of years of study, it is possible to give only a very rough and unsatisfactory glare specification, which, in the case of a state code, leaves altogether too much to the individual judgment of inspectors.

For example, the codes of the States of Pennsylvania and New Jersey simply require that lamps shall be properly shaded to minimize glare. The New York code applies this to lamps less than 20 ft. (6.1 m.) above the floor level. Wisconsin, which is experimenting with specifications a little more definite, provides that lamps suspended at elevations above eye level, less than one-quarter their distance from any position in which work is performed, must be shaded in such a manner that the intensity of the brightest square inch of visible sources will not exceed 75 cp. Lamps suspended more than 20 ft. above the floor are excepted. For local lighting this code provides that the brightest square inch in view from any position at which work is performed shall not exceed 3 cp. This provision in the code is supplemented by a number of explanatory notes.

From this you can see that a very vital welfare factor is involved. It is evident that a degree of glare which is a serious objection to one operation may be harmless for another. As a considerable economic factor is involved, it is important to avoid unnecessary hardships for industries in which large areas are employed for operations making only slight requirements as far as vision is concerned, and where the workers are otherwise safeguarded.

With these things in mind, I have made a few crude attempts at a design of an instrument for field measurements of glare, and several engineers of my acquaintance have worked on the problem, but I have seen nothing yet that looks practicable. I am sure that any useful development along these lines will be warmly welcomed by the illuminating profession.

G. H. STICKNEY.

Edison Lamp Works, Harrison, N. J.

Cost of Handling Ashes in a Small Plant

To the Editor of the ELECTRICAL WORLD:

SIR: In the Aug. 30 issue of the ELECTRICAL WORLD, page 458, an article appeared giving a comparison of costs of handling ashes by the old wheelbarrow method and a steam conveyor. The plant considered contained one 500-hp. and five 150-hp. boilers. The costs per day of the two systems were given as follows in the article referred to:

Old method:		
Two ash wheelers	$10.88	
One teamster	4.08	
One horse and feed	1.50	
		$16.46
After installing conveyor:		
One laborer (nine hours)		4.08
Saving in twenty-four hours		$12.38

The figures for the old method include nearly everything entering into the cost of ash removal. The figures for the new method carried one item, namely, labor. What were the charges known as "overhead," which includes interest on investment, depreciation, insurance and taxes; the maintainance charges; the cost of steam?

The plant described would probably not have in constant operation more than five boilers, one being down for cleaning. Assuming that the average load is 1100 hp. and that a boiler-horsepower-hour is developed on 5 lb. of coal, then the coal consumed per hour is 5500 lb., or 132,000 lb. (66 tons) per day. If the coal contains 12 per cent ash, the amount of this per day is a little less than 8 tons. Dividing the cost, $10.88, by the 8 tons of ashes, we have $1.36 as the cost per ton for wheeling alone. The conditions of ash removal, pits to wagon, must be rather unusual to limit a man's efforts to 4 tons per day or shift. The total cost of ash removal is 16.46/8 = $2.06 nearly. Such a cost is very unusual even for wheelbarrow removal in a small plant.

Kansas City, Mo. C. O. SANDSTROM.

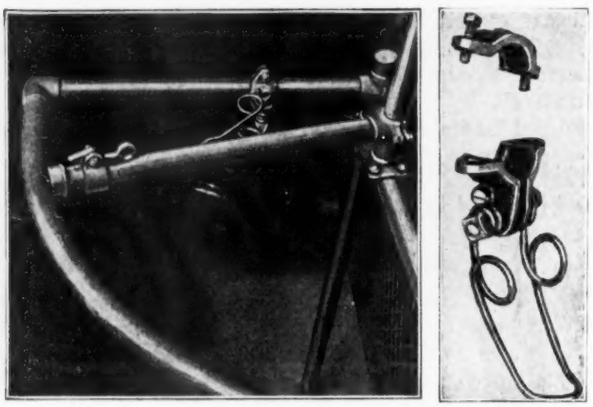
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SPRING PREVENTS ARRESTER FROM REMAINING ON CHARGE

Pushes Charging Handle Back so that Carelessness on the Part of an Operator Cannot Result in Short-Circuited Arrester

To prevent an aluminum-cell lightning arrester from remaining directly connected to a line after it has been charged, a spring device clamped to the arrester frame has been designed by Alfred Herz, engineer of



STEEL SPRING RETURNS ARRESTER HANDLE TO NORMAL POSITION AFTER CHARGING

Arrester handle locked shut while photograph is being taken

electrical tests of the Public Service Company of Illinois. When the handle is in the charging position the steel spring is under compression, and it is returned to normal position when the operator releases the handle. This device was thought necessary by the company because an aluminum-cell lightning arrester left on the line will become a hazard instead of a protection. The arrester will grow hot, dissolving the hydroxide film, and in about an hour's time the insulating oil will be hot enough to ignite. This burning oil will boil out of the tank, and in all probability it will set fire to surrounding objects and the cells will be short-circuited. Entire substations have been practically destroyed after short-circuiting of an arrester which was inadvertently left connected to the line.

PROTECTIVE MEANS FOR AN OUTDOOR BOILER BREECHING

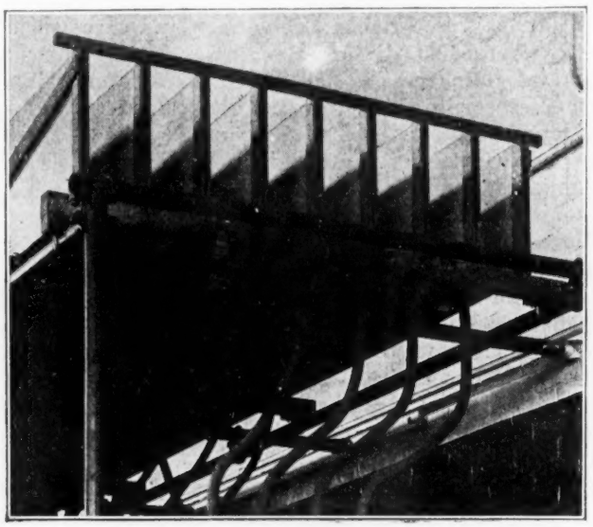
Insulation Placed Inside Breeching Protects Metal from Action of Gases and Permits Less Rapid Deterioration

The boiler-house design at the Moline plant of the United Light & Railways Company, Moline, Ill., made it advisable to put the boiler breeching on the outside of the plant. Heat insulation was therefore considered necessary to avoid excessive temperature drops in the breeching. A 2-in. (50-mm.) layer of "Vitrobestos" was fastened to the inside of the steel-plate boiler breeching by means of ¼-in. by 3-in. (8-mm. by 7.5 cm.) bolts staggered on 18-in. (45.7-cm.) centers. The joints between the sheets of insulation were "pointed up," and all exposed nuts or other metals were thoroughly coated and protected from the gases of combustion. Placing the insulation on the inside of the breeching did not affect its heat-resisting qualities, and besides it gave the additional advantage of protecting the metal on the inside surface of the breeching. With the inside surface of the breeching protected in this way and with its exterior properly painted it is felt that deterioration should be less rapid than with the usual design.

HOME-MADE BUS BARRIERS PREVENT SHORT CIRCUITS

Consist of Nine Asbestos Boards Spaced 6 In. Apart Above the Oil Switches—No Metal Used in Construction of Barriers

To prevent short circuits caused by birds or in some other such way the barrier structure illustrated here has been installed for the 2,300-volt, two-phase busbars at the Silver Lake generating station of the Pittsfield (Mass.) Electric Company. The structure consists of nine asbestos board panels ¼ in. (6 mm.) thick and 12 in. (30 cm.) high held in place by oak spacers. The vertical clamping pieces at the end are in pairs, with strips each ⅛ in. (3 mm.) thick by 1¼ in. (31 mm.)



INSULATING BARRIERS PREVENT SHORT CIRCUITS

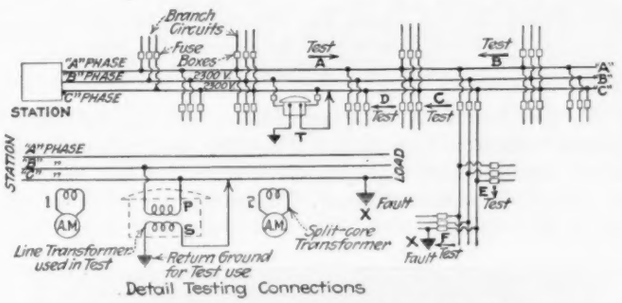
wide, with horizontal top tie bars ⅝ in. thick by 1 in. deep (16 mm. by 25 mm.) and horizontal base tie bars 1¼ in. by 1½ in. (31 mm. by 38 mm.) in section, mounted at their ends on blocks 1½ in. square clamped

to the pipe framing which supports the bus structure. The diagonal end piece shown is ⅛ in. thick and 1¼ in. wide. All the wooden framing was oil-treated before installation, and wooden dowel pins were used in place of nails to fasten the framing parts together.

LOCATING GROUNDS WITH PORTABLE TRANSFORMER

With Portable Current Transformer Position of Ground Is Determined from Direction of Current Caused by an Artificial Load

The customary procedure in locating a ground on a high-tension distribution feeder is to kill sections of the line by opening various main-line and branch-line fuse boxes until the station ground-detecting instruments show clearly when the defective section has been isolated. It is seldom possible to take these feeders out of service because of the number of small consumers, branch lines and transformers connected therewith. About the only way of testing for trouble on them has been to split the feeders into sections and isolate the defective part. Besides being slow and tedious, this process entails an interruption to the consumers fed from the section of the feeder on which the troubleman opens the fuse boxes, during the period required for him to descend the pole, telephone the station to ascertain if the ground has been cleared by the killing of that section of line, remount the pole and close the boxes. Furthermore, the fuse boxes frequently have broken down while being opened under heavy load, causing additional interruption.



METHOD OF TESTING TO LOCATE GROUND

The artificial circuit required is shown at *T*. *A*, *B*, *C*, *D*, *E* and *F* are the directions of test currents that will be observed at various points indicating the boundaries of fault.

One way in which grounds may be located without these objections is to establish an artificial circuit anywhere on the grounded phase, by means of the transformer shown at *T*, causing current to flow from that point to the ground. The direction of this current will indicate the relative direction from the testing point to the ground. From tests made at different parts of the feeder the boundaries of the artificial circuit may be determined and the ground fault located.

To illustrate the method used a typical 2300-volt distribution feeder with its main and branch lines is shown herewith. A ground somewhere on the "C" phase of it is indicated by the station ground detectors. The troubleman selects a distribution transformer fed from the grounded phase, of such size—15 kw. to 50 kw.—as will give him ample testing current, and which is not carrying load or only such load as may be cut to another transformer. The transformer is disconnected from the secondary distribution lines. One side of its secondary winding is connected to a known ground, a trolley-wire pole or fire hydrant; the other side is used as the test lead and connected to the grounded conductor of the feeder, as at *A* in the figure.

Full-load secondary current of the transformer will flow through the "C" phase conductor from the point *A* to the ground, shown at *X*. By connecting a split core or portable current transformer on the "C" feeder conductor on each side of the distribution transformer—as at 1 and 2 in the detail drawing—the current of the artificial circuit will be found to exist only in the direction of the arrow, or away from the station. A jump is made along the main line to, say, the point *B*, where the current transformer when put on the "C" phase registers only the normal current of the feeder, showing that the artificial circuit does not extend this far and that the ground lies back toward the station. Tests at points *C* and *D* give the same results as at *B*. The trouble therefore lies in the branch between *A* and *D*. At *E* the extra current is obtained, and the test at *F* definitely locates the fault in that spur.

Before establishing the artificial circuit the troubleman ascertains the load of the feeder at that point by means of his current transformer. For the return-ground connection to the distribution transformer a high-resistance connection must be obtained in order to limit the current and prevent an overload burning out the transformer. The ground connection to the transformer is made before the test-lead connection to the feeder conductor. Before making the latter the current transformer is placed on the test lead and that lead merely touched to the feeder conductor, while the ammeter is being observed to see if the transformer takes too much load. Should such be the case, the ground connection is changed to obtain greater resistance, and with the current transformer in place on the test lead this lead is flashed against the feeder conductor and the ammeter watched. When a suitable current has been obtained the test lead is permanently connected to the feeder conductor and so left until the troubleman has completed his tests at different points on the feeder and definitely located the trouble.

Philadelphia, Pa. FRANK GILLOOLY.

COMMUTATION IMPROVEMENT INCREASES EXCITER CAPACITY

Removing Shims from Behind Field Poles and Providing New Brush Equipment Offsets Reactive Kva. and Heavy Overloads

Owing to the heavy station loads and the very large proportion of the Baltimore reactive kva. thrown on the Holtwood plant of the Pennsylvania Water & Power Company steps had to be taken recently to provide additional excitation when the requirements approximately reached the limit of the installed apparatus. It was first thought that a new exciter set would have to be obtained, but a plan was worked out which obviated this expenditure. This consisted of removing the shims from behind the field poles of the waterwheel-driven set to improve the commutation and of replacing the original brush structure by a new type of improved design. By making these changes it is expected that the available direct-current capacity of the station for excitation will be increased by 800 amp.

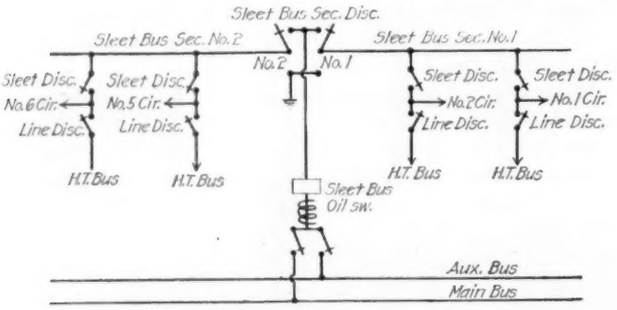
At the time of this change switching equipment was tested for the higher rating, and with the exception of

ammeter shunt the existing installation was found of sufficient capacity to operate safely under the increased loading. This additional excitation capacity at a nominal expense will take care of the excitation and direct-current requirements for some time to come.

MELTING SLEET FROM HIGH-TENSION LINES

It Disappears When the Cables Become Energized by Means of Current Flowing from Low-Tension Buses

In order to prevent sleet from forming on the high-tension lines and thus jeopardizing service, facilities are provided by the Consolidated Gas, Electric Light & Power Company for quickly connecting the Baltimore



ELIMINATING LINE TROUBLE FROM SNOW AND SLEET

and Lancaster circuits to a low-tension bus. By this means it is possible to feed the proper amount of heating current directly from the low-tension bus into the high-tension circuit. The lines are short-circuited at the opposite end from the source of supply. Sleet will drop off the wires within a few minutes after they have been heated.

Ordinarily if high-tension circuits were paralyzed the telephone service would likewise be interrupted, although the supplying end of the line would not know of any trouble. This difficulty, however, is eliminated by means of a high-tension signaling system.

The installation at the Baltimore end consists of a short-circuit bus and the necessary disconnecting switches, series transformers and indicating instruments for each circuit. Most of this equipment was available for service during the last two winters and has been used with success on several occasions. It practically eliminates snow and sleet trouble as a source of service disturbance at a very negligible loss of capacity.

N. B. HIGGINS.

Baltimore, Md.

LIFE OF RECTIFIER TUBES USED WITH SERIES ARC LAMPS

Average Cost per Street Lamp for Tubes Needed for the Rectifiers from July 1, 1918, to July 1, 1919, Amounted to $3.29

During the year ended July 1, 1919, the average life of mercury-arc rectifier tubes used in connection with the series magnetite street-lighting system of the Southern California Edison Company was 754 hours. As there were 2275 arc lamps on the entire system supplied through these rectifiers, the average cost per lamp per year for tubes amounted to $3.29. The average life of tubes obtained in different substations or districts varied from 205 hours to 1852 hours, and the cost per lamp per year varied in a like proportion. This variation can be attributed to the operation and care of station regulator equipment and also to the condition of the circuits as regards freedom from grounds, etc.

The vacuum in these rectifier tubes is often restored by boiling them in water for about an hour. A little "Bon Ami" is used in the boiling water to remove the oil and clean the tube thoroughly. This process restores a good many tubes for additional use.

In stations where proper operating temperatures are not reached because of the local conditions, good results have been obtained by warming the oil to 65 deg. C. (149 deg. Fahr.) before starting the rectifier. This is easily done by inserting an incandescent lamp in the oil for a short time.

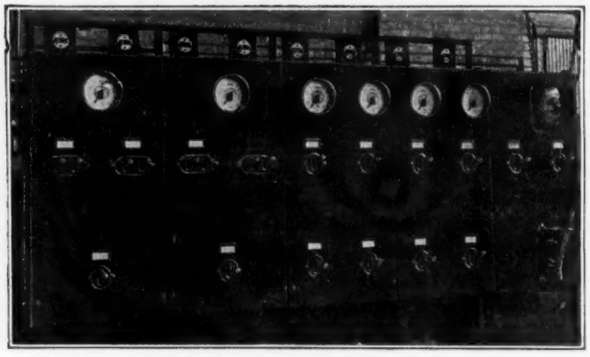
F. B. LEWIS,
Superintendent Los Angeles District.

Los Angeles, Cal.

SERIES INCANDESCENT SWITCHBOARD HOME-MADE

Five-Panel Board Built by Pittsfield Electric Company for Substation Use Saves 50 per Cent of Purchase Cost

At the Renne Avenue substation of the Pittsfield (Mass.) Electric Company a five-panel switchboard for series incandescent lighting circuit control has recently been built by the company. The panels are of asbestos board, the standard size being 2 ft. wide, 3 ft. 8 in. high



ASBESTOS BOARD PANELS SAVE 50 PER CENT OF THE COST OF A NEW BOARD

and 1 in. thick (60 cm. by 100 cm. by 2.5 cm.) mounted on 1¼-in. (31-mm.) pipe framing. At the top there is a row of jacks for testing or for pilot-light service, mounted on 6-in. by 8-in. (15-cm. by 20-cm.) fiber bases ¼ in. (6-mm.) thick, carried on 1¼-in. by ¼-in. strap iron. The lower switches control the energizing of the primaries of the regulators, installed on the floor behind the board, and the upper switches control the outgoing circuits. Those on the two left-hand panels are arranged so that if trouble occurs on either loop of a pair of outgoing circuits, one loop may be cut out of service and the other maintained. A totalizing watt-hour meter and main switch governing the supply of energy to the entire installation of regulators and rectifiers (used in connection with local street arc service) are provided on the right-hand panel. It is estimated that the company saved 50 per cent of the cost of a new board by building the one illustrated.

INDUSTRIAL APPLICATIONS

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

ELECTRIFIED OIL WELL PROVES TO BE ECONOMICAL

Allows a Saving of $3,665 in the Drilling of One Well and Requires Very Little Operating Attendance

Figures compiled by the engineers of the Empire Gas & Fuel Company at Bartlesville, Okla., show that the company saved $3,665 by the use of electric power, as compared with the cost of steam power, in the drilling of its No. 27 Stokes well in the Eldorado field. The report given out by the company showed the new method to be exceedingly simple. Except to have fuses replaced on two or three occasions, no serious trouble was encountered with the 75-hp. driving motor. The company figured the saving as being due in part to the motor, which cost $1,625, a saving of $237 over the cost of a boiler and engine, and in greater degree to the elimination of fuel oil, which with steam-driven equipment would have cost $2,160. Other small savings were obtained in the smaller depreciation per well, amounting to only $257.50, and in the cost of water, which was cut down from $480 to $60. In only one instance was the cost with electricity greater, and that was in installation. The excess here was due to the fact that the equipment was new and changes had to be made involving labor charges that it will not be necessary to figure in the future.

METHOD OF OBTAINING VARIOUS TEST VOLTAGES

Potential of Generator Made to Boost or Buck Line Voltage in Order to Provide Right Potential to Test All Motors

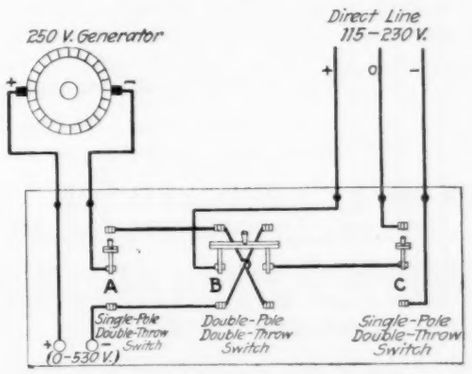
Motor repair shops are usually situated where only one source of energy is obtainable and some means must be devised to obtain both direct and alternating current energy at various voltages. Sometimes different-type generators are installed, but this method is obviously expensive and usually repair shops are not equipped with the means for wide voltage variation.

A rather wide range of voltages was obtained in a repair shop in the Middle West by the use of a 250-volt generator for bucking or boosting a constant potential of 115 volts or 230 volts. In this way a voltage range of zero to 500 volts was made available. Switches are arranged so they can be manipulated to get the range of voltages shown in the accompanying table. By adjusting the field rheostat small gradations of voltage can be obtained on account of the field being well saturated.

SWITCH CONNECTIONS FOR CHANGING VOLTAGE

Voltage At	Switch Position			Action of Generator
	Switch A	Switch B	Switch C	
0–70	Up	Down	Down	Bucks line voltage of 230 v.
35–185	Up	Down	Up	Bucks line voltage of 115 v.
150–300	Down	Open	.....	Works alone
265–415	Up	Up	Up	Boosts line voltage of 115 v.
380–530	Up	Up	Down	Boosts line voltage of 230 v.

On alternating-current work voltage variation is obtained from a polyphase generator by varying the field in small steps. Two field rheostats are used in series. Both are of the same current capacity, but one has



OBTAINING A WIDE VOLTAGE RANGE

seventeen resistance steps of nearly 2 ohms each while the other has twenty steps of 0.1 ohm each, which makes the total resistance of the smaller unit equal to one step of the larger unit. The two rheostats are geared together with a twenty-to-one ratio so that with proper timing of the gears a step on the higher unit is cut in just after the lower unit passes from "all resistance in" to "short." Thus by continuous rotation of the handle on the smaller unit a resistance variation by the small steps of this unit is obtained throughout the wide range of the higher unit. E. E. GEORGE.

Chicago, Ill.

METHODS USED IN TESTING FOR ALTERNATING CURRENT

Waving Stick in Front of Bulb—Touching Conductors to Carbon or Water—Lamp Bulb and Magnet Test

Waving a stick before an incandescent bulb, a very common test for alternating current, will present to the eye a series of images of the stick as it swings through the arc if the current is alternating, and merely a blur if the current is direct. If a piece of carbon is placed in series in a circuit, by simply resting conductors against it at two points a distinct buzzing sound will emanate from the carbon with alternating current but none at all with direct current. Practically the same effect will be noticed by touching the two conductors lightly to the surface of water.

A test that is not only excellent for detecting very slight alternations in a current but also a fair indicator

of fluctuations in cycle and voltage may be performed as follows: Introduce an incandescent carbon-filament bulb, one with the simple loop filament, between the poles of a permanent magnet. The filament will oscillate rapidly in step with the cycle of the current. At first its movement may be rather erratic, but by careful adjustment of the bulb's position in the magnetic field it may be limited to a steady oscillation which will appear to the eye as a broad band of light, sometimes $\frac{5}{16}$ in. (8 mm.) across its widest point. A change in cycle will be indicated by a hesitancy in the oscillation of the filament until it regulates its movement again to the different cycle. Voltage increase or decrease is indicated by a corresponding increase or decrease in the breadth of the oscillation. This action of a filament carrying alternating current is produced regardless of the material or alloy of which the filament is formed. It is not advisable to use a tungsten bulb because this filament is not so rugged as the carbon filament and is strung so closely that short-circuiting of the filament along one or more points of its length would follow if the adjacent sides of a loop of the filament should oscillate only $\frac{1}{4}$ in. (6 mm.)

JOSEPH BRAFF.

New York, N. Y.

DATA SHEET EMPLOYED FOR TESTING INDUSTRIAL MOTORS

Lists Manufacturer's Guarantee of Both Machine and Motor and Records All Tests Since Machine Was in Use

When motor-driven machines have a constant and regular output, such as printing presses, automatic screw machines, etc., the record and test card produced here has proved extremely valuable. Each machine in the plant has an individual card on which the manufacturer's guarantee of both the machine and motor is listed. This in itself gives a fairly good idea of the suitability of the motor for the machine.

Every time the machine is tested the results of the test are recorded on the data sheet, and it is easy to make a comparison between the requirements and the actual operation. If the number of duty cycles (impressions) per hour is low, it can be readily seen what adjustments are necessary.

W. A. HARRIS.

New York, N. Y.

MACHINE										MOTOR											
Mach. No.	Size of Bed	Driving Wheel Shaft				Gear or Pulley Data	Impression per Hour			Motor No.	Type	H.P.	Volts	Amps.	R.P.M.	Field	Size of Frame	H. P. Output	Rev. per Minute		
		Rev. per Impres.	Min.	Norm.	Max.		Min.	Norm.	Max.										Min.	Norm.	Max.

TEST								REMARKS		
Controller Notch	Volts			Amps.	H.P.	Rev. per Min.		Impression per Hour	Date		By
	Line	Arm	Field			Motor	Mach.				

ALLOWS EASY COMPARISON OF OPERATION AND REQUIREMENTS

COST COMPARISON FOR MAKING FOUNDRY STEEL

Operating Costs for Liquid Steel in the Ladle Under Favorable Conditions as Made by the Converter and Electric Furnace Processes

That the electric steel furnace is especially economical when operated twenty-four hours a day is shown in the two accompanying tables, which are included in a paper on electric furnaces read before the American Society of Mechanical Enginers recently by W. E. Moore. These figures are present-day comparative operating costs for liquid steel in the ladle under favorable conditions. The average cost per ton for two tons of converter steel, divided into per capita charges, amounts to $45.63, whereas the average cost per ton for a 3-ton acid-lined rapid-type polyphase electric foundry furnace steel amounts to only $21.59. This saving is made in spite of the fact that the fuel cost for the converter is considerably less than the electric furnace. Scrap steel can be utilized in the electric furnace whereas pig iron is necessary for the converter in most cases. In addition, the labor cost in the electric foundry is only one-third of that in the non-electric shop. With electrode cost figured at 7 cents per pound of steel, this cost amounts to $1.40 per ton of steel melted.

TABLE I—AVERAGE COST PER TON FOR TWO TONS OF CONVERTER STEEL DIVIDED INTO FOUR CUPOLA CHARGES

Two-ton Converter Charge	Cost per Ton of Liquid Steel
Low-phosphorous pig iron	$14.09
Bessemer pig iron	7.89
Steel scrap	10.14
Silicon and spiegel	5.55
Coke, 863 lb.	1.01
Cost of material per ton of liquid steel	$38.68
Additions per ton of steel:	
10 lb. 80 per cent ferromanganese at 6 cents	0.60
6 lb. 50 per cent ferrosilicon at 5 cents	0.30
2 lb. aluminum at 30 cents	0.60
Power for blower motors	1.25
Cost of materials and power per ton of liquid steel	$41.43
Average cost of cupola and converter linings	1.20
Labor costs	3.00
Cost of converter steel per net ton in ladle	$45.63

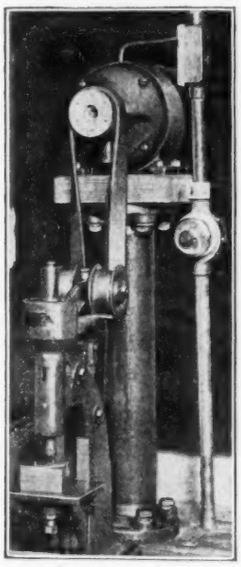
TABLE II—AVERAGE COST PER TON FOR THREE-TON ACID-LINED, RAPID-TYPE, POLYPHASE ELECTRIC FOUNDRY FURNACE STEEL

Three-ton Electric Furnace Charge	Cost per Ton of Liquid Steel
Axle turnings (included above 3 per cent losses, 200 lb.)	$12.40
Mill scale (included above 60 per cent losses, 60 lb.)	0.09
Electrodes at 7 cents	1.40
1650 kw.-hr. (550 per ton) at 1 cent per kw-hr	5.50
Losses in melting 260 lb.:	
80 per cent ferromanganese	0.40
50 per cent ferrosilicon	0.25
Aluminum at 30 cents	0.15
Cost of material per ton of liquid steel	$20.19
Average cost of linings and roofs	0.40
Labor cost on furnace attendance	1.00
Cost of electric steel per net ton in ladle	$21.59

MOTOR MOUNTING DESIGNED FOR RIVETING MACHINE

Compact and Simple Pedestal Support Provides Method of Mounting Motor Used for Short Belt Drive

By mounting the motor driving a small Grant riveter on a pedestal an unusually compact support has been obtained as shown here. The motor, a ¼-hp., 110-volt Westinghouse single-phase unit, is bolted to a 5¾-in. by 7-in. by 1½-in. (14.6-cm. by 18-cm. by 3.7-cm.) wooden base, which in turn is attached to a pipe flange mounted on a 2½-in. (6.2-cm.) pipe pedestal. Four ¼-in. (6-mm.) bolts attach the motor to its base, the motor shaft being placed with its axis at right angles to those of the main driving pulley and idlers. A smaller pedestal would serve the purpose fully as well, the size shown being used on account of its availibility.



The service for the motor and for a group of similar units mounted on the bench is carried downward from overhead branch feeders through a ¼-in. (1.3-cm.) rigid conduit equipped with a snap switch and condulet fitting for the motor. Thus the control of the motor is within easy reach of the working center of the riveter without being an obstruction.

METHOD OF ASCERTAINING CORRECT BRUSH POSITION

"Kick" Method Is Thought to Be Best Procedure as It Depends Upon Transformer Action Between the Field and Armature Conductors

Because correct brush position is of great importance in the operation of interpole machines, this is usually marked on the rocker ring by the manufacturer before shipment. On some older machines the brush position is not marked or is marked wrong, and it is usually advisable to determine it correctly. This is also important after armature rewinding. The "kick" method is thought best as it depends upon the transformer action between the field and armature conductors. To set the brush position by the "kick" method the armature cables and equalizer are disconnected and insulated. After the resistance in the field rheostat is "cut in" in series with the field the brushes are set at what is thought to be the correct position on the commutator bars, which are connected to the coils of the slots directly under the centers of the interpoles. A low-reading voltmeter (3-volt or 5-volt scale) is connected to one positive and one negative brush stud, and the main switch is closed and quickly opened again. If the voltmeter needle "kicks" one way when the switch is closed and the other way when it is opened, the brush position is wrong. The brushes should be adjusted until the position is found where the needle does not "kick."

CONSUMPTION RECORDS OF ELECTRIC MINE HOISTS

Averages for One Year from Eight Mines Show from 2.2 Kw.-hr. to 2.9 Kw.-hr. per 1000 Ton-feet Hoisted Under Different Conditions

The maximum power demand of mine hoists may vary greatly with the choice of electrical equipment, but the energy consumption seems more nearly to approach to a constant value. Records taken over a period of twelve months from eight vertical-shaft iron mines on the Marquette range, Michigan, show an average energy consumption of 2.6 kw.-hr. per 1000 long ton-feet (310 t.m.) and a maximum variation from this figure of about 15 per cent. This average energy consumption is for hoisting more than 1,258,000 long tons (1,278,000 m.t.) from an average depth of nearly 600 ft. (180 m.). The annual tonnage hoisted by the different mines varied more than five to one, and the average depth had a range of more than three to one.

ENERGY CONSUMED PER 1000 TON-FEET HOISTED FROM VERTICAL-SHAFT MINES

Mine	Long Tons Hoisted	Average Depth Hoisted (Ft.)	Kw.-Hr. per 1000 Ton-Ft.	Motor	Hp.	Drive	Type of Hoist	Unbalanced Hoist Capacity in Lbs.	Maximum Rope Speed, Ft. per Min.
A	320,893	610	2.5	*A.C.	500	Geared	Balanced cage, men and material	7000	1000
B	82,675	300	2.9	A.C.	200	Geared	Balanced skip and cage, men and material	6000	750
C	98,021	885	2.4	A.C.	400	Geared	Balanced skips for material only	6500	1000
D	146,362	400	2.6	A.C.	400	Geared	Balanced skips for material only	7000	1000
E	63,305	800	2.6	A.C.	400	Geared	Balanced skips for material only	7000	1000
F	345,909	950	2.7	2 D.C. on one Ilgner M.G. set	200 / 500	One geared / One direct-connected	One balanced gage and one balanced skip	8000	1500
G	74,297	360	2.2	A.C.	200	Geared	Balanced skips for material only	6500	600
H	126,901	435	2.6	A.C.	400	Clutch	Double-drum unbalanced skip and cage, men and material	6000	600
Total	1,258,363	.....	...						
Average	157,295	592 5	2.6						

* All alternating-current motors are three-phase, 60-cycle, 2200-volt wound-rotor type.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

INSPECTION DEPARTMENT PROVES TO BE A SUCCESS

Metropolitan Edison Company of Reading, Pa., Is Obtaining Good Results from a New Part of Its Organization

The Metropolitan Edison Company of Reading, Pa., is obtaining good results from an inspection department which was added to its organization several months ago. This department obtains any information that may be desired about service, sees that customers are billed in accordance with schedules filed with the Public Service Commission, and looks after periodic inspection of customers' equipment.

The department has greatly improved the efficiency of the daily inspection routine, increasing the average inspections per day per man from four to fourteen. Information obtained and investigations made with reference to rates being charged for different kinds of service to customers have resulted in increasing the revenues of the company many thousands of dollars per year.

The department has also taken care of nearly 3,500 changes in rate authorizations made necessary by the filing of new schedules with the Public Service Commission which became effective Nov. 1, 1919.

THE H. L. DOHERTY SCHOOL FOR SECURITIES SALESMEN

How This Organization Is Conducting a Course of Study to Give Men Knowledge of Properties and Training to Sell Securities

BY L. F. FULD

Educational Director, Bond Department, Henry L. Doherty & Co.

The Doherty school for securities salesmen was established by Henry L. Doherty & Company in the autumn of 1919 for the purpose of furnishing instruction in the fundamentals of securities to ambitious young men and incidentally of increasing the available number of securities salesmen in this country.

The school was not established primarily for the employees of the Doherty organization, although such employees are admitted to the school on the same terms as applicants from other organizations. Nor was the school organized primarily for the purpose of recruiting securities salesmen for the organization, although it is now the policy of the organization to appoint as securities salesmen only men who have completed the course of instruction in the school.

The course of study in the school, which covers a period of two months, consists of discussion periods, inspection trips, collateral reading and written tests. Of the twenty discussion periods, seven are devoted to securities, five to utilities, four to salesmanship and four to the securities of the "House of Doherty." A written test is given to the students at bi-weekly intervals, each covering the work of two weeks of instruction.

The students are taken on field trips to afford them an opportunity to inspect public utility and industrial properties from the point of view of a prospective investor. The financial and operating conditions of the company are thoroughly explained to the students on these trips, and each student is required to submit a written report on a hypothetical investment problem connected with the property inspected. A street-railway property, a telephone property, a central power station, a water plant and an oil refinery are inspected during the course of the two months of instruction.

To each member of the class a reader's card in the New York Public Library is furnished and a list of seventeen books recommended for collateral reading. The New York Public Library furnishes these cards and these prescribed books to the students in the school free of charge. The students are, for purposes of instruction, divided into two sections, each of which meets on alternate mornings from 7:45 a.m. to 8:45 a.m. in an auditorium in the financial district. Instruction is given in the morning rather than in the evening because in the strenuous business life of the present day the man who is worth while is physically and mentally exhausted in the evening and the school is interested only in men of this type. By giving the instruction under the plan followed at present each student is able to report at the desk of his present employment every morning promptly at 9 o'clock.

As to method of instruction, neither the elementary school method of having the pupils recite from text books nor the free-lance method of entertaining the students with a lecture is followed. An effort is made by means of the discussion of investment problems to draw from each student the knowledge which he possesses or has obtained from his collateral reading and to supplement this with the knowledge which he should possess to become an efficient securities salesman. It is believed that this discussion serves as a stimulus to attention and as an aid to memory.

To each student who satisfactorily meets all of the requirements of the school the diploma of the school is awarded. For graduation each of the first three fortnightly reviews is given the weight of one, the final examination is given a weight of three, and the factor of salesmanship a weight of four.. In the subject of salesmanship each student is required to make a sale to at least three customers during the time he is in attendance at the school. For his sale to the first customer he is given a rating of 40 per cent, for his sale to the second customer 20 per cent, for his sale to the third customer 10 per cent, and for his sale to each additional customer 2 per cent, with a maximum of 100 per cent. For graduation, 70 per cent is required on the factor of salesmanship, 70 per cent in the final review, and a general average of 70 per cent. The organization ten-

ders a graduation luncheon to the graduates at the conclusion of the course, and diplomas are distributed to the graduates at that time.

An effort is made to keep in touch with the alumni of the school and to assist them in every possible way in the realization of their individual ambitions. No graduate is offered a position in the Doherty organization unless he has maintained a satisfactory standing in the school and expressed a desire for such a position at graduation, nor is any graduate taken into the organization except with the knowledge and approval of his present employer.

Of the twenty-one men who successfully completed the first class in the Doherty school for securities salesmen, six were employees of the organization at the time of their enrollment, three expressed a desire to join the organization at graduation and were admitted into the organization, and of the other twelve graduates, two continued the practice of law, in which they were professionally engaged, and the remaining ten continued in the employ of the following financial and investment institutions, with which they were connected at the time of their enrollment: Manufacturers' Commercial Company, Newburger, Henderson & Loeb, Salomon Brothers & Hutzler (two); Merrill, Lynch & Company, Calloway, Fish & Company, C. D. Halsey, New York Trust Company, Noel, Berman & Langley and Stacey & Braun.

The balance sheet showing the cost of conducting the first class in the Doherty school for securities salesmen is illuminating. The gross expenses, amounting to $850, consisted of $779 for salaries and $71 for rent. Gross receipts of $913 were earned by the organization from the sale of securities by the students, and after deducting from these gross receipts the commissions paid by the organization to the students net receipts of $228 remained. By the deduction of these net receipts from the gross expenses the net expenses of the class were found to be $622. As there were twenty-one graduates in the first class, the unit cost of each graduate was $29.64.

When the commissions paid by the organization to the students are considered, it can truthfully be said that not only do the students in the Doherty school for securities salesmen receive their instruction without fee, charge or expense of any kind, but in addition the successful students are paid by the organization a liberal sum during their attendance in the school.

REPLACING COLLECTORS WITH FOLLOW-UP LETTERS

Letters Following Bills and Discontinuance of Service on Twentieth of Month Get Better Results than Two Collectors

The loss of two collectors who were called into the army during the war necessitated a new system of collecting from customers of the Indiana General Service Company, Muncie, Ind.

Under the new system bills are sent out on the first of the month. Discounts are allowed till the tenth. About the fifteenth a second notice is sent to delinquents stating politely that there has probably been an oversight but also saying that if the bill is not paid by some definite date (usually the twentieth) the service will be cut off. This is lived up to pretty strictly. To have power cut on again, a charge of $1 besides the gross charge on the bill must be paid.

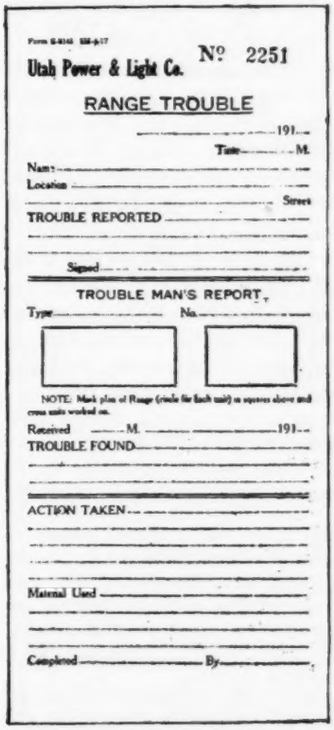
There was at first some fear of adopting this policy. There were many good accounts which had been allowed to run two, three or four months where the customers' personal relations with company officials were such that unfriendly feeling might otherwise result. However, when the customers realized that all were receiving the same treatment they were satisfied.

The number of delinquents has been reduced by 90 per cent to 60 per cent of what it used to be. Moreover, the cost of office work has not been increased and the salaries of two collectors are saved.

RECORDS IN HANDLING TROUBLES WITH RANGES

Question of How Maintenance Is to Be Handled Is Made Easier by Careful Records for Utah Power & Light Company

The question of how the maintenance department is to be handled is one of the most important which arises in the electric range business from the power company's standpoint. The Utah Power & Light Company has found that if the customer understands what has been done and what remains yet to be done, he is much less


Utah Power & Light Co. No. 2251

RANGE TROUBLE

191..

Time M.

Name

Location Street

TROUBLE REPORTED

Signed

TROUBLE MAN'S REPORT

Type No.

NOTE. Mark plan of Range (circle for each unit) as squares above and cross units worked on.

Received M. 191..

TROUBLE FOUND

ACTION TAKEN

Material Used

Completed By

FORM ON WHICH UTAH CENTRAL STATION KEEPS CAREFUL RECORD OF CUSTOMERS' TROUBLES WITH ELECTRIC RANGES

likely to become dissatisfied. Adequate records are valuable for the troubleman and the office. This company has worked out a complet set of tags, cards and office forms for its range business. The character of these is indicated by the one illustrated.

A price, inspection and delivery tag is made out in duplicate. Twin tags are attached together so that they may be readily separated, one to go on the range to the customer, the other for the files, as a means of checking defects or damage which may develop after the range has left the storeroom. On this record is placed information on the amount of installments paid and due, if any. It is found that this obviates future controversy.

Information on inspection is transferred from this form to the card record kept of each individual range.

A duplicate form is used in handling range trouble reports. These are bound in book form and one copy is perforated. The trouble call is recorded in duplicate as it comes in and the original turned over to the range troubleman, who fills in the report on the work and returns it for filing. Record of the trouble is transferred also to the card for the individual range.

This general report is kept for each electric range customer. Date of installation, details of the range itself, inspection data and record of any trouble which may develop are kept. In addition the card contains space for such information as how the customer's house and kitchen are heated, what provision there is for hot water and whether the electric range displaces a coal or a gas range. This elaborate record also provides the necessary information for bringing about the sale of an electric water heater.

HANDLING RURAL BUSINESS IN STATE OF MINNESOTA

Company Collects $41,000 in Bonuses for Contracting Farm Lines in 1919 and Has Equal Prospects for 1920

One of the companies that have worked out a definite proposition to submit to farmers who wish transmission-line electric service is the Minnesota Gas & Electric Company of Albert Lea, Minn. Working under the program which the company has laid down, it has been able, according to H. L. Nichols, president, to take in something more than $41,000 in cash bonuses during the summer and fall of 1919. In that period it connected approximately 100 farms, and it has prospects of contracting with about as many more during the spring of 1920. The company's transmission-line proposition, as explained in one of its leaflets, follows:

Main transmission lines at 6,600 volts or higher from the company's generating plant in Albert Lea can be run to villages within a 20-mile (32-km.) radius from the generating plant. A proposition is made to the village at the end of such a line to vote the company a cash bonus toward the cost of the line on the basis that if a similar cash bonus can be raised from the farmers along the highway the company will proceed immediately to construct the line and furnish light and power service within a reasonable period thereafter at rates the same as would be made to these parties if they lived on Broadway in Albert Lea, plus about 10 per cent to cover losses in transmitting electrical energy to the villages and farms.

For example, a village located 10 miles (16 km.) from Albert Lea and large enough to furnish a substantial number of customers would be asked to pay a cash bonus to the company of approximately $7,000, about 30 per cent to 35 per cent of which would be returned to the village in the way of free service for street lighting, pumping, etc.

The farms within ¼ mile (0.4 km.) of the highway along this 10-mile (16-km.) line would be expected to advance a cash bonus of $250 each in case it was possible to obtain an average of three farms per mile. If only two farms per mile (1.6 km.) would contract, the average cost for the twenty parties would be $375. In either case the initial signers who made the line possible would divide equally the bonus to be paid by farmers who contracted after the line was built. Branch lines up to 5 miles (8 km.) in length can be constructed, and the farmers served would pay about $800 per mile toward the cost.

A ten-year contract would be made with each farmer specifying a minimum annual charge of $50 per farm, which would permit each farmer to use a total of 400 kw.-hr. during the year and all consumption over and above that amount to be billed at the end of the year at the rate of 8 cents per kilowatt-hour.

The initial bonus payment of $250, or more as the case might be, would be paid as follows: 25 per cent when the contract took effect, 50 per cent when the poles for the main transmission line were set, and 25 per cent when electric energy was available along the transmission line. Each farmer would further be required to advance about $120 toward the cost of transformers, lightning arresters, cut-out switches, service connections, etc., at the time they are installed, $50 of which would be returned to each in the way of free electric service up to the minimum charge for the first year.

The result of the above arrangement from the farmer's standpoint is that by making an investment of less than one-half the minimum cost of an individual light plant he obtains twenty-four-hour electric service not only for lighting but also for power up to 10 hp. in motors, and the total cost of electrical energy for both light and power is less than the depreciation item alone on an individual plant. At the same time the individual plant will not permit use of power for more than a 1-hp. motor, and then not with entire satisfaction. Farmers who have already contracted for this service have increased the value of their farms from $15 to $25 per acre and have obtained a commodity which not only greatly assists them in the labor problem but substantially increases the efficiency and progressiveness of their entire farm operations at a lower annual cost than could be obtained by any other method.

PUBLIC POLICY IN BILLS TO CONSUMERS OF ENERGY

How the Southern California Edison Company Uses Its Statements to Cultivate Public Feeling that It Seeks to Please

Very few customers are so perverse as to be annoyed at the mere receipt of their bill for the month's electricity, and yet in the receiving of every bill lie possibilities of misunderstanding. Possibly the amount is more than the customer feels just; possibly a mistake has been made in the past which he feels should have been rectified. The absence of all personal contact which must be part of the dealings of a large company with its subscribers is emphasized in the little printed slip which requests payment before such and such a day of the month.

> It is the desire of the Southern California Edison Company to give its consumers the best of service at all times and it welcomes any suggestion looking to the improvement of the service. Consumers are requested to address all communications to Southern California Edison Company, 134 W. Main Street, Santa Paula, Calif., or telephone 178
>
> The co-operation of our consumers will be greatly appreciated and all communications will receive prompt and courteous attention.

CULTIVATING GOOD RELATIONS WITH CUSTOMERS

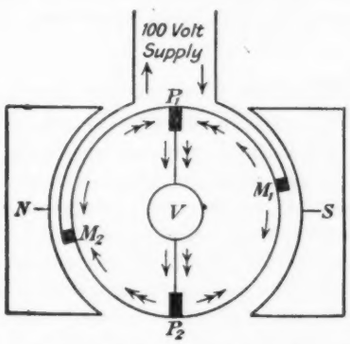
In order to forestall any feeling of annoyance, or the attitude of looking upon the electric utility as a cold-blooded corporation without any save a financial interest in customers, the Southern California Edison Company has adopted the custom of utilizing the reverse side of the bill for advertising purposes. Occasionally, of course, this involves the advertising of some one type of appliance or of a campaign which is being carried out, but more often it is a direct statement of good will toward customers.

DIGEST OF ELECTRICAL LITERATURE

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

A Back Emf. Booster.—G. BOWRON.—This paper is devoted to a description of a method by which the value of the back emf. can be made greatly to exceed that of the supply. Experiments were made with a 240-volt series fan motor, which was run unloaded on a 100-volt supply. An extra pair of brushes were provided as shown in the diagram. The two main brushes, M_1 and M_2, are connected to the supply. The normal position of these brushes is at the top and bottom of the diagram, but they are so arranged as to swing on either side of this position. In this way, any desired lead, forward or backward, can be given to the main brushes. The second pair of pilot brushes shown as P_1, P_2 are also



VARIOUS VOLTAGES PRODUCED AT *PP* BY MOVING BRUSHES *MM*

adjustable, but unless otherwise stated they are used in the position shown in the diagram. They are connected to a voltmeter which indicates approximately the voltage generated in the armature by its rotation in the field. In the experiments brushes M_1 and M_2 were shifted in the forward direction from a position adjacent to P_1 and P_2 to a position of about 85 deg. lead. As the lead approached 40 deg. there was a rise in speed, accompanied by a rise in voltage at P_1 and P_2. As the brush lead was increased the speed still further rose until at 60 deg. the voltage was 160 and at 75 deg. the pressure reached its maximum at 190 volts. Beyond this point the speed and pressure dropped rapidly, and at 85 deg. the armature stopped. Similar results were obtained by giving the brushes backward lead. The author says that a large motor used as a step-up booster, as indicated in this article, should be efficient, but careful designing would undoubtedly be necessary in order to get sparkless commutation.—London *Electrician*, Oct. 24, 1919.

Lamps and Lighting

The Searchlight in the United States Navy.—RALPH KELLY.—The types and uses of searchlamps and signaling lights on naval ships are briefly described. A changed form of 12-in. (31-cm.) incandescent light is suggested which will insure the lamp-bulb filament always being at the focal point of the mirror and of the correct type for the application. The present type of low-power searchlight has many faults. These faults may be corrected by supporting the carbons rigidly near the arc, the positive carbon being held at the focal point by a simple automatic control. The best size and material of carbons should be used regardless of the burning ratio. There is room for a material reduction in the number and complexity of the parts in the high-power searchlamps in use at present. It is believed there is also a possibility of a considerable improvement in the electrodes. The use of the dome glass door enables a searchlamp to operate in close proximity to large-caliber rifles and makes it possible to build successfully even larger sizes of searchlamps than those at present in use. The star shell has great possibilities, but it is doubtful if it will ever supersede the high-power searchlight.—*Proceedings A. I. E. E.*, December, 1919.

Generation, Transmission and Distribution

Water Power in Iceland.—SAETERSMOEN and C. RABOT.—Iceland is, for its size, tremendously rich in water power, an estimate indicating 4,000,000 hp. available on the island, whose total area is a little bigger than Maine's. Upon initiative of the Norwegian engineer Saetersmoen, a power company with Norwegian backing has recently been formed for exploitation of a series of falls in the Thjorsà, about 60 miles (90 km.) from the capital Reykjavik on the south coast. The project calls for a total of six plants, aggregating about 700,000 hp. during five months, with over 1,000,000 hp. available during the rest of the year. Owing to the peculiar meteorological conditions the water supply is very steady. The estimated cost per horsepower and year in Reykjavik is 24.70 kr., or about $6. It is planned to utilize part of the energy for nitrogen fixation. An interesting project is said to be under way leading to importation on a large scale of grain from Canada over the Port Nelson route to Reykjavik, where powerful electric mills are to be erected, their product to be shipped to consumers directly through the main European ports.—*Tekn. Ukeblad*, Jan. 17, 1919; also *Revue Générale d'Electricité*, Sept. 20, 1919.

The Seattle-Spokane Transmission Line.—Regarding the recently completed transmission line to supply energy to the Western Division of the Chicago, Milwaukee & St. Paul Railway for electrified service it is said that about 28,000 hp. will be used, which will be divided between the Long Lake plant of the Washington Water Power Company and the Snoqualmie plant of the Puget Sound Traction, Light & Power Company. The transmission voltage is 100 kv. and the trolley voltage 3000 kw., direct current, which permits spacing of substations about 25 miles (40 km.) One interesting type of plant supplying energy to this system is a hydroelectric induction-generator plant operated without

attendant and controlled from another generating plant on the Natches River. The accompanying table shows how power factor will be controlled at various loads, based on the potential at Long Lake remaining constant at 110,000 volts per phase and the potential at Snoqualmie remaining constant at 95,000 volts per phase:

	Load	Power Factor	Current
Snoqualmie	0	0 lag	78.25
Long Lake	834	69.8 lead	6.28
Snoqualmie	3,000	25.5 lag	71.30
Long Lake	3,636	80.4 lead	23.70
Snoqualmie	6,000	52.8 lag	69.00
Long Lake	6,765	85.7 lead	41.30
Snoqualmie	8,000	69.7 lag	69.80
Long Lake	9,015	87.5 lead	54.10
Snoqualmie	11,000	82.8 lag	80.70
Long Lake	12,738	95.8 lead	69.80

—*Stone & Webster Journal*, November, 1919.

Code Rules in High-Potential Systems.—G. S. LAWLER.—The writer discusses the advisability of extending the rules on high-potential systems in the national electrical code.—*Electrical Review*, Nov. 15, 1919.

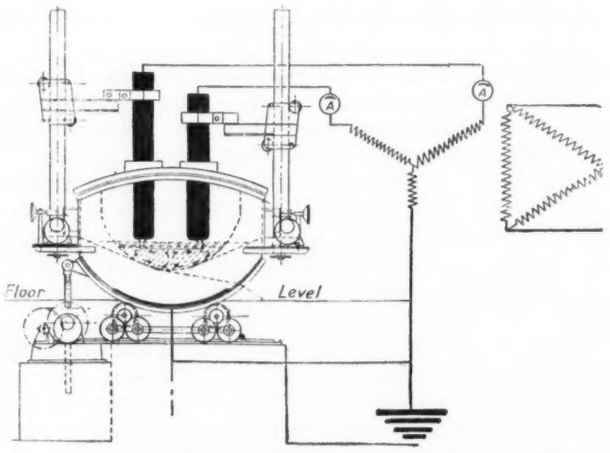
Standardization of Working Voltages of Electrical Plant in Germany.—Although standardization has been carried out to a considerable extent in Germany, there is still a great absence of uniformity in some directions. This is specially so in regard to terminal and long-distance line voltages. The Verein deutscher Ingenieure has therefore prepared a draft scheme proposing the following uniform working voltages: For direct current—220 and 440 volts as a rule for all cases; 550, 750 and 1,000 volts for railways only; 110 volts only for extensions. For three-phase current, 50 cycles—220 and 380 volts terminal voltage; further, 120 volts in new plants only where these are in damp and saturated rooms; also 500 volts for new plants operating with heavy-duty hoisting machinery. For high tensions, 6,000, 15,000, 35,000, 60,000, 100,000 and 150,000 volts as a rule; also in special cases, 3,000, 5,000, 10,000, 25,000 and 50,000 volts, particularly where connection with an existing feeder of the same voltage is probable. The Swiss Electrotechnical Society has also suggested uniform or standardized voltages which will take into account both existing and future progress. This will be helped by the fact that nearly 90 per cent of all motors in Switzerland are three-phase motors. The energy suggested for the standardization is therefore three-phase at 50 periods. It is assumed that the interlinked voltage will be used for motors and large consumers and the phase voltage mainly for lamps. For transformers three groups of standard voltages are suggested, in which, in addition to the ordinary star-delta connections (voltage ratio: 1:3), six equal collecting coils will be used, which will give three different voltages, in the ratio 1:2:3, according as the grouping is in delta, series, or parallel or zig-zag. The half-coils will have 125, 110 and 75 volts respectively in the three groups of voltages. With a half-coil voltage of 125 volts there would thus be standard voltages of 250/440 and the special groupings of 220/380 and 125/220 volts.—*Technical Review*, Oct. 28. (Abstracted from *Zeitschrift des Vereines deutscher Ingenieure*, Aug. 2, 1919).

Traction

Relationship of Items of Cost Under Pre-war Conditions and To-day.—F. W. DOOLITTLE.—After giving hypothetical costs and incomes for a typical electric railway operation in 1914 and again for 1919 the author arrived at the following conclusions: (1) The tendencies toward higher cost of operation noted in studies made prior to 1914 have developed into revolutionary changes in price levels. (2) It is believed that these changes are permanent rather than transitory or temporary in character and affect all components of the cost of service, including return upon the investment. (3) The analysis of cost of service made for a typical property indicates that the increase in fundamental costs incurred can only be partially offset under the most favorable and economical conditions of handling traffic. (4) Because of the large influence of the cost of platform labor, the new level of costs results in far greater increases in those costs which vary with the miles traveled per passenger than in those costs which are fixed in their nature irrespective of the length of haul. This indicates that the discrimination which has always existed between long-haul and short-haul passengers is constantly becoming greater and that our previous ideas of the cost components in a zone system of fares must be modified. (5) The increased cost occasioned in complying with higher standards of service during rush hours is vitally affected by the recent additions to costs of labor arising out of the application of the minimum wage and the provision of higher unit pay for overtime work.—Toronto *Electrical News*, Nov. 1, 1919.

Installations, Systems and Appliances

Electric Furnaces in Metallurgy.—The object which the designers of the Greaves-Etchells furnace had in view was the arrangement of a furnace in which the intense concentration of heat around the arcs would be avoided. Such concentration leads to destruction of the refractory lining near the arcs. It also seemed desirable to secure a steady working load consistent with a reasonably high power factor. Better distribution of heat can be obtained by resistance methods. Consequently the furnace was built so that some of the heat had been generated in the lining of the furnace itself. Mechanically, the furnace does not differ much from others in the method of making connections and of detailed features which have been altered in the light of acquired experience. Electrically the furnace differs from others in the method of making connections and of grouping the transformer windings. Each electrode is independently regulated for the purpose of maintaining a good load factor. The furnace was therefore designed



ARRANGEMENTS FOR INDEPENDENT CONTROL OF THE TWO ELECTRODE CIRCUITS

with a hearth connection which would act as an opposite terminal to each electrode entering the upper portion of the furnace so that an arc can be maintained on one electrode only quite independent of whether the other suspended electrodes are in connection with the bath, A brief reference to the figure will show that a lagging power factor is obtained on one-half of the system and a leading power factor is obtained on the other half of the *Y* so that, provided that each half of the system is evenly balanced, the over-all power factor is as near unity as is practically possible. A very efficient connection is obtained by cementing the hearth of the furnace to a large copper plate over the steel plate in the furnace bottom.—London *Electrician*, Oct. 17, 1919.

The Electric Control of Steel-Mill Auxiliaries.—C. HOWARD.—The choice of system, whether alternating-current or direct-current, requires careful consideration. So far the majority of installations have been carried out with direct-current motors. Automatic control, as against hand control, is particularly advantageous in steel works. With regard to types of control the author gives four classes and proceeds to give details of these. Certain items of plant require special forms of control, and, as examples, mention may be made of approach rollers, manipulators, screw-down gear, swinging table and skids. Reference is also made to hydraulic pumps and air compressors.—London *Electrician*, Sept. 26, 1919.

Telegraphy, Telephony and Signals

Applicability of Automatic Switching to All Classes of Telephone Service.—ARTHUR BESSEY SMITH.—The author deals with the advantages and general usefulness of automatic telephony. The subscriber's requirements are independent of the means used to satisfy them. Automatic switching is uniformly fast and involves reduced mental stress to the user because the passing of the number is positive and waiting time is reduced to the minimum. As viewed by the owner the apparatus has longer life, the service is very acceptable to the public, and but a tithe of the female employees are used. Automatic switching apparatus has increased greatly in margin of safety. Much progress has been made toward standardization of form and toward best methods of maintenance. A few changes in structure are described and data given to show margins of safety in operation. Present practice regarding party lines and measured service (cash and credit) is stated briefly. The durability of automatic equipment is illustrated by the fact that plants have not yet worn out. Maintenance routines are essential to successful operation. Girls do routine testing with marked success. Rural telephone lines present problems which have been solved in several ways, influenced by the greater number of telephones per line, the conditions of signaling subscribers, and the inferior insulation often encountered. Code ringing can be retained. Rural automatic service is only a little inferior to city automatic service. The community automatic exchange serves a small group of subscribers, either isolated or part of a telephone network. The rotary line switch is used because it is simple, reliable, quick-acting and provides twenty-five trunks. Toll switching in an automatic exchange gives the toll operator direct dealing to the subscriber, complete control over his line and periodic ringing. The toll network has also been improved by applying automatic switches to intermediate points, so that the originating toll operator can set up the complete connection herself. The experience of the past twelve years shows that this increases the business-carrying capacity of toll lines at least 50 per cent to 100 per cent.—*Proceedings A. I. E. E.*, December, 1919.

Determination of Rate of Deionization of Electric Arc Vapor.—HENRY G. CORDES.—After discussing the deionization and consequent loss of conductivity of mercury vapor carrying a momentary arc, the author considers an arrangement of circuits for determining the rate of deionization, and the effect of this rate on the voltage required for a subsequent reignition. The theory of the circuits shown is given and illustrated by numerical examples. It is suggested that the arrangements shown be experimentally carried out because of possibly important practical applications.—*Proceedings Institute of Radio Engineers*, October, 1919.

A Special Type of Quenched-Spark Radio Transmitter.—D. GALEN MCCAA.—A quenched-spark transmitter is so arranged that the capacity in the highly damped primary circuit is that between a special extra antenna and ground, and the primary and secondary circuits are partly inductively coupled through a common inductance in the ground lead and partly capacitatively coupled by the capacity between the special antenna and the usual secondary or radiating antenna. Quenching effects and normal mono-wave radiation are secured. Experiments are described and an oscillogram shown whereby the group frequency and radiation characteristics are indicated.—*Proceedings Institute Radio Engineers*, August, 1919.

Electrochemistry and Batteries

German Electrotechnics During the War: Electrometallurgy.—V. ENGELHARDT.—Electric blast furnaces were not started, but the steel production in electric furnaces increased from 89,336 tons in 1914 to 279,700 tons in 1917, the electric steel production of these two years making up 48.4 and 62.8 per cent of the special steel (crucible and electric). In Austria-Hungary the electric steel production rose in the same years from 15,844 tons to 47,152 tons, the proportions being very similar. Induction furnaces predominate in Austria, arc furnaces in Germany. Instead of deoxidizing the iron with ferromanganese fused calcium carbide is now successfully used. The copper of the driving bands of shells can be replaced by electrolytic iron. After experimenting on a large scale, two new electrolytic iron works, for 200 tons per month, were erected at Munich (Siemens-Halske) and Bitterfeld (Griesheim-Elektron). The latter plant is not yet complete. The process is that of Langbein-Pfanhauser and Fischer-Martin iron anodes in ferrous chloride, to which hygroscopic salts are added. For the refining of copper from brass (door brasses, picture frames, taps, crucifixes, etc.) and bronze (church bells) several refineries were built. The brasses are fused, the zinc is oxidized and the copper gained by electrolysis. In the electrolysis of the bronzes the stannic acid, passing into the anode mud and into the electrolyte, first caused difficulties. The bronze of old bearings is dealt with in special works, and a good tin is there obtained. As regards aluminium, bauxite deposits in Carinthia, Dalmatia and Hungary have been worked, and clays are said to have been purified. Particulars about the latter purification are not yet available.—*Science Abstracts, Section B*, Sept. 30, 1919. (Abstracted from *Elektrot. Zeits.*, May 8, 1919.)

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

News in Brief

Summary of Important Happenings in the Industry During the Week

Passage of the water-power bill by the Senate is a long step toward enactment, and the industry is awaiting the action of the conferees with keen anticipation of conditions which will permit real development. In advance of any facts as to the final terms it is impossible to estimate what amount of development will take place in the near future. Certainly any workable conditions which will invite capital investment or risk will be followed by prompt construction and the utilization of powers now wasted. The more encouragement there is to capital of small risk, safety of principal and sure return, the more readily will private investors advance funds.

The hydroelectric power bill urged by the conference of mayors of New York State cities last year has been introduced again in the Legislature. It provides for state development of water powers and for the sale of the energy to municipalities or private parties.

The lease of properties of the Sierra & San Francisco Power Company to the Pacific Gas & Electric Company for fifteen years has been approved by the California State Railroad Commission. The total rentals amount to $2,000,000.

The Pacific Gas & Electric Company has included in its budget for 1920 $15,000,000 for extensions and new capital expenditures, including $3,000,000 for the Pit River development.

The new-business co-operations committee of the Ohio Electric Light Association met at Akron on Jan. 21. H. C. Stephens of Akron spoke on "Electric Drive in the Rubber Industry from the Central-Station Viewpoint."

The Commonwealth Edison Company of Chicago and the Public Service Company of Northern Illinois have opened a permanent stock and bond department through which securities will be sold directly to the public. The securities of the Middle West Utilities Company will probably be added to the list of stocks and bonds handled.

A controlling interest in the Connecticut Power Company is to be purchased by the Hartford Electric Light Company, according to present plans.

President Maclaurin of the Massachusetts Institute of Technology died suddenly of pneumonia on Jan. 15.

Sir Oliver Lodge, the noted British scientist, who is to lecture in the United States and Canada on psychic and physical subjects, reached New York on Jan. 15.

An issue of $12,500,000 of two-year 6 per cent secured notes of the Philadelphia Electric Company, sold to bankers, is offered on a 7¼ per cent interest basis.

England's electricity supply bill, as finally passed, does not provide for compulsory nationalization of power supply, and the plan will be effected through voluntary action of the joint electricity authorities.

The Indiana Public Utility Association has been organized with Charles L. Henry as president to consider common problems of utilities of the various classes and to enlist public co-operation.

The wiring committee of the N. E. L. A. Commercial Section asks central-station appliance department managers for results of commercial experiences with portable cords for heaters.

At the annual meeting of the Engineering Institute of Canada, to be held at Montreal on Jan. 27 to 29, many subjects, including the water powers of Quebec, will be discussed.

The electric production and distribution sections of the Empire State Gas and Electric Association held meetings at Schenectady, N. Y., on Jan. 14 and 15 at which some very interesting discussions were presented on periodic apparatus inspection, meggers versus high-voltage insulation tests, application of relays, insulator practice and training linemen. The sections were presided over by L. C. Reynolds and W. C. Blackwood respectively.

The supply jobbers are enjoying a continued high rate of business, hampered to some extent by poor stocks of staples. This stocking feature is not improving any in general because transportation is holding up and lengthening shipments. Socket demand is heavy, but stocks are now in sufficiently good shape to allow lower prices. Frequently incoming shipments of pipe, loom and flexible armored conductor do not touch jobbers' storerooms but are transhipped from the terminal or from the sidewalk. Much of this material the jobbers have sold for three months ahead. Loom deliveries are reported a little better. Local transformer stocks are better, but local motor stocks are badly broken.

Central stations are ordering apparatus in better quantity than usual at this season. It is becoming more general for jobbers to order supplies for longer periods in advance than ever before. No chance of quicker deliveries is seen. Prices have advanced on several lines. High-tension porcelain insulators, bushings and accessories are up 5 to 10 per cent; a certain line of single-phase motors is up 10 per cent, and of fractional motors 5 per cent; sewing machines advanced 10 per cent, bells and buzzers 10 per cent, cross-arms 20 per cent, and in the West knife switches and safety switches went up 5 to 25 per cent, condulets 20 per cent and friction tape 15 per cent. Jobbers are asking more for flexible armored conductor, supply of which is very short.

A 50,000-kw. hydro-electric plant, known as the Tugaloo Development, will in all probability be started by the Georgia Railway & Power Company on the Savannah River near Tallulah Falls within a year. It will take from two to three years to complete it. The generating stations which this will supplement, as well as the system served, were indicated in the May 17, 1919, issue of the ELECTRICAL WORLD, page 1025.

Among the large projects contemplated throughout the country is the construction of a second transmission line between Athol Springs and Dunkirk, extensions to distributing systems in Brocton and Ripley and the towns of Hamburg, Eden and Brant, and for improvements and additional equipment in substations at Gardenville and Dunkirk by the Niagara & Erie Power Company of Buffalo, N. Y. The Public Service Commission has authorized the company to issue $685,000 in bonds and notes to pay for same.

The towns of Geneseo and Little River, Kan., have voted bonds to extend the transmission line of the United Water, Gas & Electric Company of Hutchinson, Kan., to a distance of about 14 miles north of the present terminus. Efforts are also being made in four other towns west of Geneseo to issue bonds to secure service from the company, and if the project goes through the transmission line will probably be extended another 40 miles west of Geneseo. Work has been started on the erection of a 35,000-volt line south from Hutchinson for a distance of 35 miles. When completed it will supply electricity to Arlington, Partridge, Langdon and Turon. Another line is under construction from Sterling to Alden. This line will eventually be extended to Great Bend and Kinsley.

WATER-POWER BILL IS PASSED BY THE SENATE

This Sends the Measure to Conference Between Members of the Upper and Lower Houses, and Important Changes Are Forecast

By a vote of fifty-two to eighteen the Senate on Jan. 15 passed the water-power bill. The measure now goes to conference. It is a foregone conclusion that important changes will be made in the bill by the conferees. The conferees on the part of the Senate are Senators Jones of Washington, Nelson of Minnesota, Bankhead of Alabama, Smoot of Utah, Fall of New Mexico and Myers of Montana, and those who will represent the House are Representatives Esch of Wisconsin, Sinnott of Oregon, Haugen of Iowa, Sims of Tennessee, Taylor of Colorado and Lee of Georgia.

The votes against the bill were fewer than had been expected. Senators voting against the measure were Borah of Idaho, Gore of Oklahoma, Gronna of North Dakota, Harris of Georgia, Harrison of Mississippi, Kenyon of Iowa, Kirby of Arkansas, Lenroot of Wisconsin, McCormick of New York, McKellar of Tennessee, Norris of Nebraska, Nugent of Oregon, Reed of Missouri, Shepherd of Texas, Stanley of Kentucky, Tramell of Florida, Walsh of Massachusetts and Williams of Mississippi.

COMPENSATION FOR PRIVATELY USED WATER POWERS

The amendment relating to compensation for the use of water powers utilized by private capital and not by the government, which had been lost by one vote in committee of the whole, was voted upon again in the Senate proper and was passed by a vote of forty-four to twenty. The amendment as adopted reads as follows:

That the licensee shall pay for the license herein granted such reasonable annual charges as may be fixed by the commission for the purpose of reimbursing the United States for the cost of administration of the act in relation to water powers developed under its jurisdiction, in the proportion that the water power developed by the project covered by said license bears to the total water power developed by all projects licensed under the act, and for that purpose such charges may be readjusted from time to time, not oftener than once in two years; the licensee shall also pay for the use and occupation of any public lands and lands in reservations, except tribal lands embraced within Indian reservations, necessary for the development of the project covered by the license such reasonable annual charges based upon the actual value of the government lands used as may be fixed by the commission; but in no event shall the annual charge for the foregoing exceed 25 cents per developed horsepower: provided, that when licenses are issued involving the use of government dams or other structures owned by the United States or tribal lands embraced within Indian reservations the commission shall fix a reasonable annual charge for the use thereof, and such charges may be readjusted at the end of twenty years after the beginning of operations and at periods of not less than ten years thereafter in a manner to be described in each license.

The five provisions of the measure which were characterized by Gifford Pinchot as being anti-public and indefensible were not adopted except the one striking out the Senate committee amendment relating to joint approval of contracts and the one limiting to some degree the amount of severance damages. The Pinchot objections, which were pressed very strenuously by Senator Lenroot and others and which it is expected will receive consideration in the conference, are as follows:

1. Section 10 (e) gives the public water powers away for practically nothing by relieving licensees from paying the reasonable value of what they get from the public. It limits the possible charge to the reimbursement of the government for the expenses of administering the act, plus a small charge based on the value of government lands occupied, irrespective of their water-power possibilities. Thus it prevents any charge being made for the enormously valuable water-power rights to be granted under the bill. When a municipality is to develop and use the power for its citizens a nominal charge is right and just, but when a corporation or individual is to be given publicly owned rights and make a profit from them it is clear beyond question that a reasonable charge, based on the value given, should be made.

The right to make such a charge is clear. To abandon it for the profit of the corporations would be wholly unjustifiable. The water-power commission should be given a free hand to charge what the rights granted are actually worth. This grave defect in the bill can be remedied by striking out the Senate committee amendment.

2. Section 22 gives the public service commission of a state the power to decide alone that a contract may extend beyond the end of a license, apparently with the intention that the national government, or its new licensee, shall be saddled with obligations as to the making of which it will have had no voice, no matter how unfair, disadvantageous or costly to the public interest they may be.

This provision is absurd on its face. Merely to set forth its apparent intention condemns it. Again the fault can be cured by eliminating the Senate committee amendment.

3. The provision for "severance damages" in Section 14, page 25, lines 1 to 5, is without justification and should be omitted from the bill. The taking over of the property after fifty years of notice has nothing analogous to that in which the owner is suddenly deprived of a part of his property against his will, and in justice requires no severance damages at all. No valid argument can be made for damages based upon anything more than the loss of use for some short period of not more than three years while necessary changes are being made.

4. At the end of Section 15 the bill contains provisions which are calculated to make a license perpetual. These are contained in the words "on reasonable terms" and "which is accepted," line 20, all of which should be stricken out. The word "shall" in line 20 should be changed to "may." The rights of a licensee will then surely and automatically terminate at the end of fifty years, as they should, and no collusion or other device will avail to make them indefinite. Of course, the typographical error in line 20 must be corrected by changing "license" to "licensee."

5. The bill provides that certain items, if any, shall be deducted from the legitimate original cost of a project in order to determine the price to be paid therefor when taken over by the United States or another licensee. But it fails to provide that these proper and necessary reserves shall be made at all. This omission would mean the unjustifiable loss of millions of dollars to the government. It can be cured by striking out the words "reserves for such purposes" in line 3, page 17, and substituting therefor the words "amortization, sinking fund, and other similar reserves, if and as required by the commission, but such reserves shall not be so made as to prevent a fair return upon the net investment."

THE GREAT FALLS DEVELOPMENT

As finally passed by the Senate, the bill contains the authorization for a $25,000,000 power development on the Potomac River at Great Falls and gives to the federal Power Commission all the authority vested in the Newlands commission. It is regarded as not improbable, however, that both of these provisions of the bill will be stricken out in conference. The Newlands commission was empowered to study development and control of waterways and water resources and subjects relating thereto and to study the matter of bringing into co-ordination and co-operation the engineering,

scientific and constructive agencies of the governmental departments so as to make recommendations as to irrigation, drainage, forestry, reclamation, clarification of streams, regulations of flow, control of floods, utilization of water power, prevention of soil erosion and waste, storage and conservation of water.

The matter of development of water power on Indian reservations called forth considerable debate, but an amendment by Senator Nugent prevailed after determined opposition on the part of Senator Walsh of Montana. Among other things the amendment agreed to provided that "in the case of tribal lands embraced within an Indian reservation which said lands were ceded by the Indians to the United States by treaty, no license shall be authorized except by and with the consent of the council of the tribe."

An effort was made by Senator Nugent to amend the bill so that it would not take effect until the expiration of three years after its approval by the President. This amendment had the support of only a few votes.

EMPIRE STATE ASSOCIATION SECTIONS MEET IN SCHENECTADY

Periodic Inspection, Insulation Testing, Application of Relays, Testing Insulators and Training Linemen Among the Topics

Two days of very lively and interesting discussion on timely operating subjects developed from the meetings of the production and distribution sections of the Empire State Gas and Electric Association on Jan. 14 and 15. Both sections held their sessions at the Mohawk Hotel in Schenectady, L. C. Reynolds being chairman of the production section and W. C. Blackwood chairman of the distribution section.

At the first day's session the principal topics discussed were periodic inspections of station apparatus, meggers versus high-voltage testing of insulation, stoker operation and relay application. Testing of insulators, outdoor substations, fusing of transformers and training linemen were among the subjects considered at the second day's session.

G. M. Parsons, Syracuse Lighting Company, outlined a very comprehensive plan of periodic inspection which his company follows. In the discussion which followed it was the consensus of opinion that inspection should not be put off as a rainy-day job, but that it should be carried on systematically and periodically, giving particular attention to auxiliary apparatus which might be overlooked otherwise and making arrangements whereby the equipment can be thoroughly inspected without interrupting service. It was also brought out that the frequency of inspection should depend on the importance of the service and the frequency with which different kinds of defects occur. The frequency with which different inspections are made was cited by men representing various New York companies.

Among the persons who took part in this discussion were E. P. Peck, Utica Gas & Electric Company; C. S. Van Dyke, Schenectady Illuminating Company; V. Poston, New York & Queens Electric Light & Power Company; D. B. Taylor, Troy Gas Company; H. W. Morreall, Utica; W. C. Pearce, Syracuse Lighting Company; Sydney Alling, Rochester Railway & Light Company, and W. C. Blackwood, New York & Queens Electric Light & Power Company.

Sydney Alling, Rochester, presented a paper on "Meggers Versus High-Voltage Testing," in which he pointed out that a megger may be suitable for determining insulation resistance but that it is not indicative of dielectric strength.

In line with this subject K. V. Farmer, Syracuse, W. C. Blackwood, Long Island City, E. P. Peck, Utica, and L. C. Reynolds referred to the conditions under which the induction or "woodpecker" method of locating faults and the slide-wire bridge methods give satisfaction.

I. E. Powell, Rochester, cited some experiences with burning coke breeze and anthracite screenings.

O. C. Traver, General Electric Company, emphasized the importance of applying relays properly, discussed time setting and compared induction and plunger-type inverse and definite time relays as to proper field of use. Different methods of protection such as in reverse power, balanced and differential relays were considered.

Troubles with relays and methods of avoiding them were touched on in the discussion by E. P. Peck, W. C. Blackwood and Mr. Lyon of Buffalo. Mr. Peck urged manufacturers to make relays more rugged and even sacrifice efficiency if necessary. Complicated relay connections should be strenuously avoided. Mr. Blackwood said that differential relays on transformers have tripped during heavy loads on the secondary side without any failure in the transformers or apparent faults in relay connections. It is possible that excessive increase of transformer losses with great loads may have caused the relays to trip. Mr. Lyon had had trouble in securing protection on lines with the neutral grounded through a relatively high resistance.

L. N. Crichton, Westinghouse Electric & Manufacturing Company, explained in some detail the manufacturing of insulators and discussed the causes of insulator failure, mechanical tests for flows, methods of reducing failures and relative advantages of various electrical testing methods.

This subject was discussed quite extensively by E. P. Peck, Utica, and A. M. Perry, ELECTRICAL WORLD. Details of their remarks will be presented, with features of other discussions, in later issues of the ELECTRICAL WORLD. In general Mr. Peck referred to the oscillator, and the hot-and-cold water tests, use of the "buzz stick" and telephone-receiver method for detecting faulty insulators and protection of insulators from flash-overs. Mr. Perry referred to an extensive investigation which the ELECTRICAL WORLD has made of operating companies' practices in using insulators, testing and inspecting them, costs of testing, causes of failures, methods of avoiding them, etc.

C. M. Rhoades referred to an 18,000-kva., 66,000/6,600-volt outdoor substation at Nashua, N. H. (see ELECTRICAL WORLD, Jan. 17, page 139), constructed of concrete poles, channel irons, rigid buses and pin insulators. This contains 28 tons of steel, and the poles cost $60 apiece. Without transformers and switches, the substation costs 95 cents per kva.

The construction of outdoor substations was discussed by E. P. Peck, B. E. White of Utica, L. N. Crichton, K. V. Farmer and C. S. Van Dyke. Mr. Peck referred to the practice of the Georgia Railway & Power Company, with which he was formerly connected, saying that it has standardized on a few types of industrial substations to avoid the delay often occasioned by designing each station separately, to permit keeping

stock parts in readiness, and to facilitate assembly. Such substations can be erected within ten days after receiving a request for service.

B. E. White called attention to the opportunity for co-operation between electrical and mechanical or civil engineers in designing such stations, saying that more attractive stations with 50 per cent of the steel ordinarily used have been constructed through such co-operation. The use of stock pipe parts and fittings for constructing outdoor substations was referred to by Messrs. Crichton and Farmer. To indicate the possible life of concrete poles Mr. Van Dyke said that some have been in service in Schenectady since 1893.

T. S. Spates mentioned a training school that has been established by the New York & Queens Company for developing linemen needed because of the labor scarcity. The Public Service Electric Company of New Jersey has a similar school.

ENGINEERING INSTITUTE OF CANADA TO MEET IN MONTREAL

Three-Day Meeting to Be Held in Conjunction with Montreal Branch Provides Opportunity for Discussion of Many Subjects

The annual meeting of the Engineering Institute of Canada will be held at Montreal on Jan. 27 to 29, inclusive. A professional meeting of the Montreal branch of the Engineering Institute will be held at the same time at which a number of papers will be presented dealing with water powers and other development.

The program for the three days is as follows:

Tuesday, Jan. 27

9:00 a.m.—Opening of registration at headquarters, 176 Mansfield Street.

10:00 a.m.—Reception of reports.

1:15 p.m.—Luncheon at Windsor Hotel for members and ladies and invited guests.

1:50 p.m.—Formal welcome and greeting.

2:00 p.m.—Address, "Modern Highway Problems," by F. W. James, assistant chief engineer Bureau of Roads, Washington, D. C.

2:45 p.m.—Resuming of business session.

4:20 p.m.—Address of retiring president.

5:00 p.m.—Inauguration of incoming president.

9:00 p.m.—Reception and dance, Rose Room, Windsor Hotel.

Wednesday, Jan. 28

10:00 a.m.—"The Training of the Chemical Engineer," by R. F. Ruttan, professor of chemistry, McGill University; "The Importance of Physics in Engineering Education," by A. H. Eve, Macdonald professor of physics, McGill University; discussion by four authorities on technical education.

1:10 p.m.—Visit to Northern Electric Company's works.

1:30 p.m.—Luncheon, as guests of the president of the Northern Electric Company.

7:45 p.m.—Annual banquet of the Institute, Rose Room, Windsor Hotel.

Thursday, Jan. 29

10:00 a.m.—"Quebec's Water-Power Policy and the Work of the Quebec Streams Commission," by Olivier Lefebvre, chief engineer Quebec Streams Commission; "The Operation of the Quebec Public Health Act," by Theo. J. Lafrenière, chief sanitary engineer to the Superior Board of Health of the Province of Quebec; "Quebec Highways," by Alex. Fraser, assistant chief engineer Quebec Department of Roads.

2:30 p.m.—"The Pulp and Paper Industry," by Fred van Bruyssel; "The Policy of the Air Board of Canada," by Lieut.-Col. O. M. Biggar, vice-chairman of the Air Board of Canada; "The Forests of Quebec," by G. S. Piche, chief of Forests Service, Quebec Lands and Forests Department.

8:30 p.m.—Smoker, Windsor Hotel.

PRESIDENT MACLAURIN OF M. I. T. DIES SUDDENLY

Distinguished Scientist and Executive Rebuilt Great School of Engineering for a Future of Increasing Service to Civilization

Dr. Richard Cockburn Maclaurin, sixth president of the Massachusetts Institute of Technology, mathematical physicist, lawyer, educator and executive of world-wide reputation, died suddenly on Jan. 15 at his home in Cambridge, after less than a week's illness from pneumonia. Overwork on behalf of the great endowment drive which was concluded on Jan. 10 amid much rejoicing by friends, alumni and others affiliated with the institute is believed to have cost the life of "Boston Tech's" self-sacrificing head, and his unexpected passing was the greater shock because of his active concern for the success of the endowment campaign and the joy which he felt in its full accomplishment. Dr. Maclaurin was at his office in the institute on Jan. 9, and at the jubilation banquet on Jan. 10, when the success of the campaign and the identity of "Mr. Smith," Technology's most notable benefactor, were announced, the regretted absence of the institute's president was believed to be due only to a temporary indisposition.

THE LATE PRESIDENT MACLAURIN

President Maclaurin was born at Lindean, Scotland, in 1870 and was the son of a distinguished mathematician, Robert Campbell Maclaurin. His family went to New Zealand when he was a boy, and there he received his grammar-school education. His preliminary education was completed in the English schools, and in 1892 he entered the University of Cambridge, where he took the degrees of B. A. and M. A. As an undergraduate he displayed proficiency in mathematics and won the Smith prize for excellence in this study. After his graduation he was elected a Fellow of St. John's College. For ten months after receiving his M. A. degree he toured the United States and Canada, studying the educational institutions of the two countries. He then returned to England and took up the study of law at Cambridge, where he was awarded the McMahon studentship, the most highly esteemed honor of its kind at the university. For six months, on leave of absence, he studied in Germany, and shortly after his return to Cambridge he won the Yorke prize for his thesis on

"The Title to Realty," which gained worldwide attention. The *Law Quarterly*, commenting upon this thesis, said: "It gives promise of a real school of legal history which may flourish and bear fruit, notwithstanding the general apathy of the profession toward anything not of obvious utility in practice."

Leaving the law school at Cambridge in 1898, Dr. Maclaurin went to New Zealand to take the chair of mathematics at New Zealand University, a post which he filled for seven years, contributing notably toward the development of scientific education in the colony. He became dean of the faculty of law and served until 1907, when he accepted the chair of mathematical physics at Columbia University, succeeding Dr. Robert S. Woodward, who had resigned to become president of the Carnegie Institution at Washington.

On June 7, 1909, Dr. Maclaurin was inaugurated president of the Massachusetts Institute of Technology. Here he faced the problems of conserving the fruits of the institute's noble past, planning for its larger continuance and establishing the school in a new home in which it might expand into higher and broader planes of usefulness to the world of applied science. The old quarters had been outgrown, and Dr. Maclaurin early realized the necessity for removal to a new and unhampered site. He devoted much time and energy to building up loyalty to the institute among its alumni, and one of the first fruits of this policy was the gift of half a million dollars by T. Coleman du Pont toward the purchase of a new site in Cambridge. The alumni backed up the president with enthusiasm in the campaign for building funds, and under his direction the splendid new plant at Cambridge was erected.

Through Dr. Maclaurin's efforts the interest of some of the country's leading philanthropists has been attracted to the institute, notably that of George Eastman of Rochester, N. Y., not an M. I. T. graduate, but whose benefactions, under the pseudonym of "Mr. Smith," have brought the institute $11,000,000 in the past seven years. Dr. Maclaurin came to the presidency of the institute at a time when the industries of the world were being enlarged and enriched by the discoveries and applications of science and when there was a more pressing demand than ever before for the best technical education. The institute was brought more and more into line with the demands of the industrial world for aid in research, and the so-called "Technology plan," by which many industrial plants, public utility organizations and engineering firms will "retain" and use the special organization of the institute now being created for this purpose, was recently declared by Dr. Maclaurin to be probably the most important step the institution has taken since its foundation.

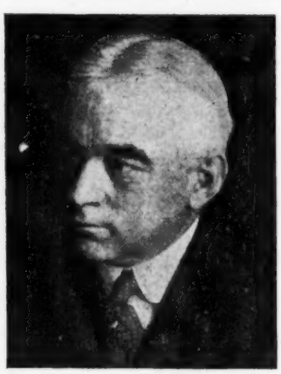
During the war Dr. Maclaurin performed great services for the government. He turned the entire plant and personnel over to the United States authoritites, thousands of young men were instructed in the theory and mechanism of aviation, and the institute also furnished the men and the influence which dominated the United States Shipping Board in its establishment of maritime schools throughout the country. He also advised the government upon many matters relating to the intensive training of military engineers and other auxiliaries to the fighting forces. After the close of the war he devoted himself heart and soul to placing the institute in a position from which its existing and potential resources may be developed to their maximum usefulness, unhampered by the severe financial limitations which threatened to retard its work and prevent its expansion.

Dr. Maclaurin was the holder of numerous degrees from institutions of learning and was a member of a wide range of scientific and philosophical societies. He was the author of many scientific theses, including "The Theory of Light" and other treatises. Cambridge (England), Wesleyan, Harvard, Denison and Dartmouth have borne witness to his distinction by degrees conferred. He was an able executive, extremely popular with the student body of the institute, and loyally supported by the faculty. His influence as a citizen and educator was recognized in tributes by Governor Coolidge of Massachusetts and many others.

DR. WALKER HEADS M. I. T. INDUSTRIAL DIVISION

Strong Organization for Industrial Co-operation and Research Created Which Holds Contracts Aggregating Nearly $1,000,000

Dr. William H. Walker, formerly head of the research laboratory of applied chemistry at the Massachusetts Institute of Technology, has been appointed head of a new division of industrial co-operation and research. Dr. Walker has been on the staff of the institute for over twenty-five years and head of the applied chemistry research laboratory for the past twelve years. The success of this laboratory has been noted in many parts of the country, its facilities being used extensively by such concerns as the General Electric Company, National



DR. W. H. WALKER

Tube Company, Vacuum Oil Company and Goodyear Tire & Rubber Company. During the war Dr. Walker served as a colonel in the Chemical Warfare Service and was in command of the Edgewood Arsenal, where 15,000 men were manufacturing poison gas for use against the Germans. He was awarded the distinguished-service medal with a citation for his technical ability, industry and zeal.

By the institute's new plan all its resources are placed at the service of American industry and already 120 large concerns have contracted for co-operative and research work designed to bridge the gap between the institute and the world of business by making it possible for the clients of the school to consult the institute staff and utilize laboratories and libraries in the

solution of their problems. The program also includes putting clients in touch with sources of information and other scientific libraries and institutions the world over. It is understood that the annual retainers now agreed upon range from $1,000 to $25,000.

Of the work of the new division Dr. Walker said:

"Whenever a manufacturer runs upon a problem that requires research or information not at his disposal, he can consult our division. We can give him all the information on his problem which we have at hand. This means all the information which any member of our great staff may have at hand.

"If we do not have it here, we can tell him where he will be most likely to find it, whether in other institutions and libraries of this country or abroad. If he requires special service in an experimental or research way, we will arrange consultations, investigations, tests or research with our technical staff. Or, if necessary, we can put him in touch with outside sources. This means, of course, that we must maintain records of the qualifications, experience and special knowledge of our alumni as well as of men now studying at the institute. The significance of this departure by the institute is evident to any one who has observed the difficulties of big concerns in hunting out special knowledge which they require; and its significance for Technology is just as great, for we appreciate how much it will mean to us to be brought in closer touch with the practical problems of the industrial world. We want to meet the industries more than half way. It means, too, a large field for new income for the support of the institute. There could be no more legitimate way for a great scientific school to seek support than by being paid for the service it can render in supplying special knowledge where it is needed. Already contracts we have signed total between $900,000 and $1,000,000."

Among the clients of the institute are the Edison Electric Illuminating Company of Boston, Stone & Webster, the American Telephone & Telegraph Company, the General Electric Company, Arthur D. Little, Inc., the Pierce-Arrow Motor Car Company, the American International Corporation, the United States Steel Company and the United States Rubber Company.

PHILADELPHIA ELECTRIC COMPANY SELLS NOTES

Issue of $12,500,000 Secured Two-Year Notes Purchased by Bankers and Offered to Public on 7¼ per Cent Interest Basis

An issue of $12,500,000 of two-year 6 per cent security notes has been sold by the Philadelphia Electric Company to Drexel & Company, Harris, Forbes & Company and Brown Brothers & Company. It was offered for sale by the bankers at 97¾ and interest, yielding about 7¼ per cent. It is part of an authorized issue of $15,000,000 notes, dated Feb. 1, 1920, and is subject to call in amounts of not less than $500,000 on four weeks' notice at 101 and interest, at any time prior to Feb. 1, 1921, and on or after that date at 100½ and interest.

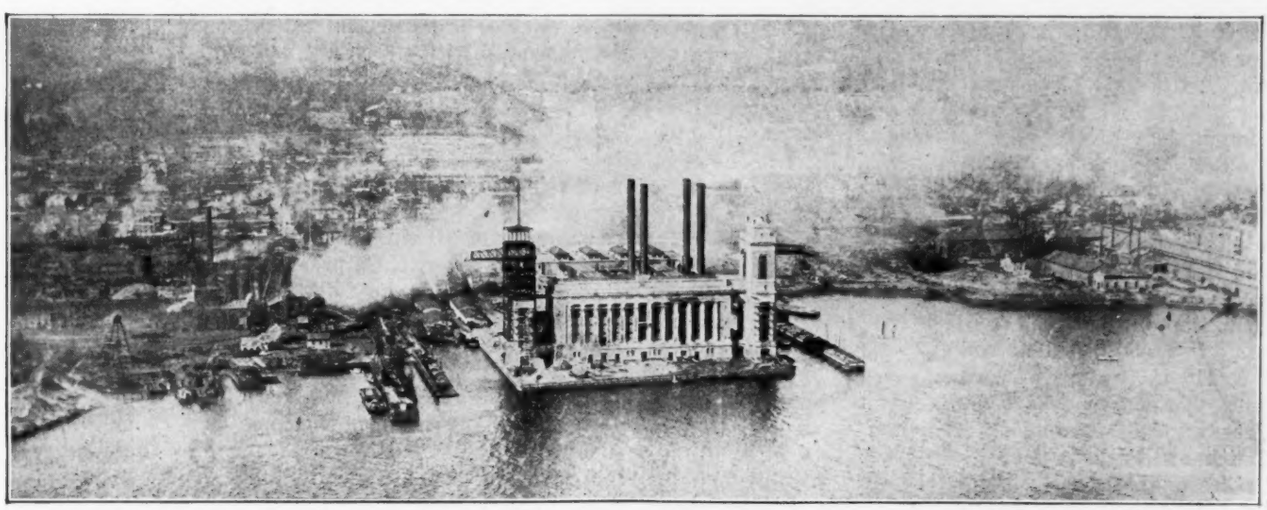
In describing the physical property of the company to the bankers, President Joseph B. McCall says:

The Philadelphia Electric Company system includes nine generating stations, having installed an aggregate rated capacity of 263,118 kw. Energy is distributed through seventy-nine substations (forty-one of which are privately owned industrial substations) over 11,180 miles of electrical conductors. The underground system comprises 2,044 duct miles of conduit. There are now in service 139,724 meters and energy is supplied to 124,808 customers.

The Philadelphia Electric Company, in order to increase its power-generating facilities and to enable it adequately to meet the present and prospective heavy demands for central-station service, is now constructing on the Delaware River at Beach and Palmer Streets, Philadelphia, a large new steam-power station. This power station is designed for an ultimate installed generating capacity of 180,000 kw., of which it is anticipated that the initial 60,000 kw. will be in operation about October, 1920. This station is being built of reinforced concrete.

The Delaware County Electric Company, to increase its power generating facilities and to augment the power supply of the Philadelphia Electric Company system, recently constructed on the Delaware River at Chester, Pa., a large steam-power station. The Chester power station is designed for an ultimate installed generating capacity of 120,000 kw., of which the initial 60,000 kw. has been in operation since October 1, 1918. This station is built of reinforced concrete and steel and in accordance with approved standards.

The Philadelphia Electric Company's Chester Station from the Air



This is a novel view of the large new Chester station of the Philadelphia Electric Company, which houses some of the great generating units providing energy for that busy industrial center.

APPARATUS COMMITTEE DECIDES ON TENDENCIES

N. E. L. A. Group Has Reviewed Progress and Troubles in All Apparatus from the Generator to the Consumers' Premises

When the National Electric Light Association convention is held in Pasadena, Cal., members will receive an exceptionally thorough report from the apparatus committee. This body, which met at Louisville, Ky., on Jan. 15, 16 and 17 to discuss its report, has completed all of its work with the exception of editing the various sections to be turned in by the sub-chairman of the committee.

The topics which will be covered this year are generators, switchgear transformers, motor rules, substations and the Bureau of Standards safety rules. In the Louisville discussion the major portion of the time was devoted to the discussion of experience and tendencies in the use of oil switches and auxiliary oil-switch apparatus.

N. E. L. A. COMMITTEE TESTS OF PORTABLE CORDS FOR HEATERS

Wiring Committee Will Measure Laboratory Tests by Commercial Experience—It Asks Co-operation from Central-Station Officials

The wiring committee of the Commercial Section of the National Electric Light Association in planning to investigate portable cords for heaters is arranging for laboratory tests, but it believes that the laboratory tests, or at least the first that will be made, will not give the practical or commercial values of the cords. In fact, what it is really aimed to do is to test the tests by comparing the results of the first tests with commercial experience, and then, by devising and arranging for other tests, finally to get a form of tests which shall as nearly as practicable conform to commercial and practical experience For this purpose the wiring committee hopes to get the managers of some of the appliance departments of central stations to give the results of their experience.

The wiring committee will prepare sheets in which the various cords to be tested will be described according to their trade name and specifications. The manager will then be asked to rate the different cords, as No. 1, No. 2, etc. The average of the ratings of a number of different appliance department managers will be computed, with the idea that such averages will give the best information at present available as to the commercial value of the different cords.

Six men have volunteered to rate the cords, but in addition the wiring committee would like to have others, and if any central-station man who is familiar with the cords on the market will volunteer to do this the wiring committee will appreciate his offer. If he will send his name to R. S. Hale, chairman, 39 Boylston Street, Boston, Mass., the list of cords, trademarks, etc., will be sent. The six who have already volunteered are C. E. Greenwood of Boston, C. Michel of St. Louis, Dorsey Smith of Baltimore, Mr. Lewis of New York, A. G. DeClercq of Chicago, and H. Calvert of Philadelphia. By adding to these representative names those of other central-station officials in all parts of the country the committee hopes to achieve ratings that will be accepted by all as authoritative.

ALL ELECTRICAL INTERESTS CO-OPERATE IN CANADA

Convention of Manufacturers, Jobbers, Dealers and Utility Operators Terminates in Banquet Attended by 600 Persons

The largest gathering of Canadian electrical men and interests ever held in Canada overflowed the great banquet hall of the King Edward Hotel, Toronto, on Jan. 16, to hear the addresses by W. L. Goodwin and Samuel Adams Chase which closed a busy two days of meetings and sessions participated in by the Canadian Associated Manufacturers of Electrical Supplies, the Canadian Electrical Supply Jobbers' Association, the Ontario Municipal Electrical Utilities Association, the Ontario Association of Electrical Contractors and Dealers, the Toronto Section, A. I. E. E., the Toronto Electric Club and the Canadian Electrical Association (Canadian Section, N. E. L. A.). More than 600 electrical men of Canada—utility operators, manufacturers, jobbers, contractors and dealers—were present at the closing banquet, having as their guests to hear Mr. Goodwin many distinguished Canadian public officials, including the Lieutenant-Governor and the Prime Minister of Ontario and several Cabinet members, the Mayor of Toronto, Senator Nicholls and others.

Following toasts by ex-Premier Hearst of Ontario, Lieut.-Col. Carmichael of the Ontario Hydro-Electric Commission and Mayor Church of Toronto, Mr. Chase, special representative of the Westinghouse company, told of the results that come through co-operation and mutual understanding.

MR. GOODWIN'S ADDRESS

Mr. Goodwin, referring to the present power shortage in Ontario caused by the tremendous new load of household appliances which has replaced and now exceeds the former 100,000-kw. munition-plant load on the "Hydro" system, declared that every possible resource for electric power on the American continent will have to be developed as rapidly as plants can be built if electrical utilities are to keep up with the tremendous demands for electricity for homes, farms and factories. He urged that private as well as public enterprise be encouraged and safeguarded to provide the power facilities which will be needed as railroads are electrified, farms served with electricity and electric service standardized for popular use. Facing this wonderful opportunity for serving mankind in the immediate future, Mr. Goodwin called for earnest, harmonious co-operation of all interests in the electrical field, under the leadership of men who have an understanding of the commercial magniture of the problems and opportunities now before the industry.

H. Munro Grier, K.C., president of the Canadian Section, N. E. L. A., who followed Mr. Goodwin, paid an eloquent tribute to the latter's "educative, expositive and extremely excellent address" and to his "tremendous capacity of mind and heart as revealed in his vision for the electrical industry of the future." "The power of co-operation," continued Mr. Grier, "is well illustrated by those tiny drops of water tumbling over Niagara, which, isolated, are swept aside by the wind in spray or wasted in the thunders of the cataract, but when harnessed and made to co-operate furnish light, heat and power, enriching the community life of whole states and provinces."

SIR OLIVER LODGE HAS ARRIVED TO LECTURE

Noted British Scientist Reaches New York and Will Talk on Psychic and Physical Subjects in this Country and Canada

Sir Oliver Lodge, the noted British scientist, reached New York on the steamship Lapland on Jan. 15. He is here to make a short lecture tour in the United States and Canada, speaking on psychic and physical subjects. The lectures announced for New York City between Jan. 22 and Feb. 8 are as follows: "The Reality of the Unseen," "The Evidence for Survival," "The Destiny of Man," "The Structure of the Atom" and "The Ether of Space."

ENGLISH ELECTRICITY SUPPLY BILL IS PASSED

Radical Changes Made in the Measure as Originally Submitted by the Government—Nationalization Abandoned

After many changes from the original draft the electricity supply bill prepared by the British government has been passed by the House of Commons and the House of Lords and has received the royal assent.

The effect of the radical changes made in the measure before it was enacted into legislation was to take away compulsory powers under which, it was contended, complete nationalization of the generation and distribution of electric power would have taken place. Instead of compulsory powers whereby the government would have dominated the industry the plan of national electricity supply will be carried out on a voluntary basis by joint electricity authorities.

HARTFORD COMPANY TO BUY CONNECTICUT POWER COMPANY

Stockholders and State Commission to Be Asked to Approve New Arrangement, Which Will Facilitate Interconnection and Development

Arrangements are being made by the Hartford Electric Light Company for the acquisition of a controlling interest in the Connecticut Power Company, and it is planned to bring the matter to a formal vote at a meeting of stockholders of the former organization Feb. 10, after which the approval of the Connecticut Public Utilities Commission will be sought. It is planned for the Hartford company to issue 7,500 shares of stock, of par value $750,000, in exchange for $1,000,000 common stock of the Connecticut Power Company.

The Connecticut Power organization is managed at present by Stone & Webster, and conferences with the Hartford company have shown that a transfer of control will be advantageous to a broad policy of interconnection and system development. The Connecticut Power Company supplies the entire gas, electric lighting and commercial power business in New London, the entire electric lighting and commercial power business in Middletown, and serves numerous other manufacturing communities in Connecticut, including Canaan, Norfolk and Thomaston. A 12,000-hp. hydro-electric plant at Falls Village furnishes energy at 66,000 volts to a transmission line running from northwest to southeast across a considerable portion of the state and connected with the Hartford, Torrington and Bristol systems. Neither company is to change its name, a representative of the ELECTRICAL WORLD is informed.

GENERATING CAPACITY OF THE LARGE SYSTEMS

Returns of Narragansett Electric Lighting Company Add 80,000 Kw. to Totals of "Electrical World" Compilation

In addition to the returns on the generating capacity of large central-station systems printed in the ELECTRICAL WORLD of Jan. 17, page 164, statistics have been received from the Narragansett Electric Lighting Company, Providence, R. I. The steam generating capacity of this company on Jan. 1, 1919, was 80,000 kw. No additions were made during 1919 and none are contemplated during 1920. Inclusion of this company would make the steam generating capacity of the large systems as of Jan. 1, 1919, 3,309,986 kw. and as of Dec. 31, 1919, 3,815,556 kw.; and it would make the total hydro-electric and steam capacity of the large systems 5,889,965 kw. on Jan. 1, 1919, and 6,715,195 kw. on Dec. 31, 1919.

Toledo Company's New Building

The Toledo Railways & Light Company has formally opened its new building and display rooms. The new headquarters were formerly occupied by a large department store. The building was remodeled completely and artistically. With the night illumination the building appears to be covered with a climbing and clinging Japanese wistaria vine, while butterflies in natural color and in motion flutter among the leaves. Huge peacocks complete this unusual picture. Floodlighting of the roof and brilliant electric signs over the canopy complete the illumination. It was conceived by George Williams, head of the new-business departments of the Henry L. Doherty companies.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

A. I. E. E., Philadelphia Section.—"Electric Furnaces" are to be discussed at the Feb. 9 meeting of this section of the American Institute of Electrical Engineers.

A. I. E. E., Los Angeles Section.—"The Engineer in Industry" will be the topic for discussion at the Feb. 17 meeting to be held by this section of the American Institute of Electrical Engineers.

American Society of Heating and Ventilating Engineers. — The annual meeting of this society will be held at the Hotel McAlpin, New York City, Jan. 27, 28 and 29.

A. I. E. E., Fort Wayne Section.—The subject of "Autogenous Welding" will be taken up at the Feb. 19 meeting to be held by this section of the American Institute of Electrical Engineers.

A. I. E. E., Indianapolis-Lafayette Section.—At the Feb. 20 meeting held by this section of the American Institute of Electrical Engineers the subject of "The Problems Confronting Electric Railroads" will be taken up.

Franklin Institute and Philadelphia Section, A. I. E. E., Joint Meeting.—The Philadelphia Section of the American Institute of Electrical Engineers and the Franklin Institute will meet jointly on March 17 to hear G. H. Clamer's paper on "Induction Electrical Furnaces."

Tri-State Water and Light Association of the Carolinas and Georgia.—The tenth annual convention of this association will be held at Atlanta on May 19, 20 and 21. Headquarters will be at the Piedmont Hotel. Manufacturers will be given necessary space for exhibits free of cost.

A. I. E. E., St. Louis Section.—The annual election of officers held by this section of the Institute resulted in the unanimous choice of G. A. Waters, chief engineer of the Wagner Electric Manufacturing Company, as chairman and Stanley Stokes of the Union Electric Light & Power Company as secretary-treasurer.

Philadelphia Section, Association of Iron and Steel Electrical Engineers.—At the Feb. 7 meeting, to be held at the Engineers' Club, R. B. Gerhardt, superintendent of the electrical department of the Bethlehem Steel Company, Sparrows Point, Md., will present a paper entitled "Electrical Features of a Modern Mill."

New York Electrical League.—At the January luncheon of the league the following were elected officers for the ensuing year: President, James R. Pollock; first vice-president, Walter Neumuller; second vice-president, F. H. Leggett; treasurer, L. L. Strauss; secretary, J. Wynne Jones; directors, James M. Wakeman, Joseph Forsyth and Harry B. Logan.

American Institute of Electrical Engineers.—On March 12 a meeting of the Institute will be held in Pittsburgh under the auspices of the traction and transportation committee and the subject of "Electric Traction" will be discussed.

Western Society of Engineers.—The men who will guide the electrical engineering section of the Western Society of Engineers during 1920 are: A. F. Riggs, chairman; C. A. Keller, vice-chairman, and T. Milton, director. The new officers of the society itself are: President, F. K. Copeland; first vice-president, C. F. W. Felt; second vice-president, J. L. Hecht; third vice-president, Linn White; treasurer, F. F. Fowle; trustee, J. H. Libberton.

I. E. S., New York Section.—Meeting jointly with the New York division of the National Council of Lighting Fixture Manufacturers, the section discussed the relations between the fixture manufacturer and the illuminating engineer. Two papers were presented, one by W. R. McCoy on "What Can the Illuminating Engineer Do for the Fixture Manufacturer?" in which he made a plea for co-operation, and the other by Bassett Jones on "Brightness, The Fundamental in Illuminating Engineering." Mr. Jones stated that engineers should give more attention to the painting of walls, ceilings and floors than they have heretofore if the best lighting is to be obtained. Among those who took part in the discussion were G. W. Cassidy, Norman MacBeth and W. B. Anderson. Herman Plaut of the fixture manufacturers and F. M. Feiker of the illuminating engineers jointly presided over the meeting.

A. I. and S. E. E., Philadelphia Section.—At a meeting of this section of the Association of Iron and Steel Electrical Engineers held on Jan. 3 J. D. Wright, electrical engineer of the General Electric Company, read a paper on "Electric Mill Drives." He discussed the subject from the standpoint of steel-mill electrical engineers and presented figures on the power consumption of motor drives per ton of metal handled by steel-mill rolls and on the flywheel weight per motor horsepower, advocating a moderate policy in flywheel design. In the discussion of the paper reference was made to the question of a wider tendency to adopt 60-cycle induction motors for steel-mill uses with geared connection so as to make possible higher driving speeds and thus to secure improved power factor. Mr. Wright referred to the importance of adjustable-speed motors for some cases of steel-mill work, but discouraged the thought of employing synchronous motors in many of the cases for power-factor correction owing to the usual condition of very large starting torque.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Condition of Transmission Line Construction.—The Pennsylvania Public Service Commission in the case of J. Morris Horst et al. vs the Metropolitan Edison Company of Reading ordered the respondent to furnish electric service to the complainants upon execution by the complainants and delivery to the respondent of a written agreement guaranteeing from the transmission line made necessary to furnish such service the payment of an annual return of $100 for five years.

"Wholesale" Rates Beneficial to All.—In a decision upholding an increase in artificial gas rates by the Philadelphia Suburban Gas & Electric Company the Pennsylvania Public Service Commission remarks that "the practice of public service companies selling large quantities of gas, water and electricity at what might be termed wholesale rates, whereby the unit of cost to the consumer is lessened, has long been recognized by both commissions and courts as being beneficial alike to the companies and all their consumers, and does not constitute unjust discrimination."

Household Appliances in Cooking and Power Rates.—Increased rates for electric service by the Moab Light & Power Company were authorized by the Utah Public Utilities Commission with the provision that the cooking or power rate should apply on electrical household appliances when used on cooking or power meters. The commission said in discussing the schedule filed by the company: "The wisdom of excluding household electrical appliances from the benefits of the cooking and power rates may be open to question. The future growth of the company's business will apparently depend largely upon the development of the small power load. The use of electrical household appliances and utensils, such as ranges, washing machines, irons, sewing machines, fans, vacuum cleaners, etc., is increasing, under the stimulus of active sales campaigns conducted by power companies. Inasmuch as most of such power is used during the daytime, and, therefore, serves to bridge a daily recurring period of minimum power demand, this company, as well as others, can probably afford to lend encouragement to the fullest use of such appliances and devices, by applying to them rates for service similar to rates accorded users of small motors. This is being done with satisfactory results by other power companies operating in this state."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Cheap Power in Pennsylvania.—The cheapest electrical power in Pennsylvania is at Mount Union, the War Department states, in announcing that it will sell its sulphuric-acid plant located at that point. Mount Union draws its coal supply from a mine within the town limits.

Narragansett Company Has Employees' Club.—The Nelco Athletic Club has been formed by employees of the Narragansett Electric Lighting Company. The object of the club is to promote good fellowship among the employees by a series of interdepartment athletic contests and social gatherings. Both men and women employees are included.

Iowa Engineers Must Register.—Any unregistered professional engineer or land surveyor practicing in Iowa after July 4, 1920, will be subject to a fine of not less than $100 nor more than $500 under a new law. This requires practicing engineers and surveyors to register upon their professional requirements without examination up to Jan. 4, 1920, and thereafter until July 4, 1920, a technical examination is required before a board of examiners. K. C. Kastberg, Des Moines, Iowa, is secretary of the board of examining engineers, and the other members of the board are Seth Dean, L. M. Martin, F W. Stubbs and Alvin LeVan.

N. E. L. A. Educational Courses.—The educational courses which were arranged by the Commercial Section of the National Electric Light Association, covering practical electricity, commercial engineering, elementary accounting and advanced accounting, were offered to employees of the Southern California Edison Company during the early part of the present winter. At present there are approximately 300 employees enrolled as follows: 280 in practical electricity, eight in commercial engineering, ten in elementary accounting, and two in advanced accounting. These courses are being supplemented by classes arranged by the company. Already classes have been held in several of the districts with an attendance of from twenty-five to seventy-five, depending upon the size of the district and the number of students enrolled therein. In the promotion of this work it was found advantageous and effective to invite all of the employees in a district to the first meeting, in order that they might gain a better idea of the purpose and worth of the course. The enrollment in one of the districts was more than doubled following the first meeting. F. B. Lewis, superintendent of the Los Angeles district of the Southern California Edison Company, is in charge of these classes.

Research Graduate Assistantships in University of Illinois.—To assist in the conduct of engineering research and to extend and strengthen the field of its graduate work in engineering, the University of Illinois maintains fourteen research graduate assistantships in the engineering experiment station. Two other such assistantships have been established under the patronage of the Illinois Gas Association. These assistantships, for each of which there is an annual stipend of $500 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics or applied chemistry. An appointment to the position of research graduate assistant is made and must be accepted for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the degree of master of science will be conferred. Nominations to these positions, accompanied by assignments to special departments of the engineering experiment station, are made from applications by the director of the station each year not later than March.

J. E. Aldred Lectures at Johns Hopkins.—The dates for the J. E. Aldred lectures on engineering practice before the department of engineering of Johns Hopkins University, Baltimore, for 1919-20 have been announced. Through the generosity of Mr. Aldred this course of lectures on engineering practice was founded. The course of lectures is one feature of a general plan, made possible by Mr. Aldred's gift, for furthering and improving undergraduate instruction in the methods and problems of the practice of engineering. During the year three lectures each will be given in the general subjects, civil, electrical and mechanical engineering. Engineers or others who may be interested in the topics will be welcomed. The lectures announced are: Jan. 28, "Common Sense in Engineering," J. E. Aldred, New York; Feb. 11, "The Development of Long-Distance Electric Power Transmission," P. M. Lincoln, Cleveland; Feb. 18, "The Purchase and Erection of Engineering Equipment," A. S. Loizeaux, Baltimore; Feb. 25, "City Planning and Its Relation to Municipal Development," Nelson P. Lewis, New York; March 3, "Reinforced-Concrete Design and Construction, Past and Present," Ernest P. Goodrich, New York; March 10, "Railroad Grade Crossing Elimination," Samuel T. Wagner, Philadelphia; March 17, "The Commercial Side of Engineering," Commander Walter M. McFarland, New York; March 24, "Engineering and Construction Organization for Rapid Work," I. W. McConnell, New York.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Negligence from Mode of Constructing Trolley Wires.—Since a defendant traction company in using an overhead trolley is in the lawful exercise of its franchise, negligence cannot be imputed to it because it used the overhead wire system (125 N.E. 93).

Trade Marks and Trade Names.—A trade name, separated from the business to which it belongs and in which it is used, is not a species of "property" and cannot be sold and transferred as such, but can only pass with some property or business with which it has become identified (125 N.E. 73).

Binding Receiver of Telegram.—The receiver of a telegram is not, in the absence of an agreement by him to that effect, bound by a contract between the sender and the company, and his failure to present his claim within sixty days as required by the regulations of the company is not a defense (125 N.E. 45).

Invalid Sale of Trade Name.—Contracts between S and Y, both using the trade name "Bankable" in connection with their product, whereby Y sold his trade name to S and agreed not to use such trade name under his prior right in a given territory can be enforced as to the negative covenants not to use the name, the invalid stipulation relative to the sale of the trademark apart from any property or business being separable (125 N.E. 73).

Injury to Boy from Live Trolley Wire.—Where a trolley wire of defendant traction company running under the bridge of a railroad company was so placed that no one standing on the bridge or even bending over the parapet could reach it, the Court of Appeals of New York has held that the defendant was not liable for injury to a boy who in crossing the bridge swung a wire about eight feet long, bringing it in contact with the trolley wire (125 N. E. 93).

Damages for Personal Injuries.—According to the Supreme Judicial Court of Maine, in the case of Nadeau vs. Caribou Water, Light & Power Company (108 A. 190), a verdict for $2,512.50 in favor of one who received a severe electric shock, burning his hand so badly that it was totally disabled for four months and causing the amputation of one of his fingers, as well as impairing his income, part of which had been gained by playing the violin, was not so excessive as to warrant the conclusion that it represented anything but the honest judgment of the jury.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

John T. Hutchinson of the Quakertown (Pa.) municipal electric light plant has resigned to become superintendent of the municipal plant at Souderton, Pa.

R. B. Woolley, who has been director of publicity of the Society for Electrical Development, Inc., for the past two years, has resigned to become associated with the Thos. F. Logan, Inc. Advertising Agency, New York City. Mr. Woolley will specialize in electrical merchandising accounts.

Thomas L. Small, formerly assistant treasurer of the Savannah (Ga.) Electric Company and for the last few months connected with the Stone & Webster properties at Brockton, Mass., has recently taken charge as manager of the properties of Stone & Webster at Baton Rouge, La.

Walter Neumuller, who has just been appointed assistant secretary of the New York Edison Company, has been associated with that company since 1900. Mr. Neumuller's progress in the company has been rapid. He started in a clerical position, advancing to the position of private secretary to Arthur Williams, general commercial manager. In 1918 he was placed in charge of all retail business of the company, which position he has held since that time. He is an active worker in a number of electrical organizations, including the National Electric Light Association.

S. M. Kennedy, general agent of the Southern California Edison Company, has been appointed a committee on public relations by President R. H. Ballard of the National Electric Light Association. Mr. Kennedy, the sole member of this important committee, will make a comprehensive report to the national convention at Pasadena in May. Because of his practical success in the field of relations with the public, Mr. Kennedy has become known generally throughout the industry. The keen study which he has made in his special province assures the high value of his report to the convention.

S. M. KENNEDY

H. W. Reilly, heretofore superintendent of the Oklahoma Gas & Electric Company at Oklahoma City, Okla., has been appointed vice-president in charge of operation, succeeding W. R. Molinard, who has recently resigned to give his entire attention to private interests in California. Mr. Reilly assumed his new duties on Jan. 1 of this year.

H. S. Brooks, who on Jan. 1, 1920, was appointed assistant vice-president in the department of accounts and finance of the American Telephone & Telegraph Company, has been in the continuous service of that company since 1892, when he started in the canvassing department. He has since held the following positions in the long-lines department: district superintendent, assistant general superintendent and general commercial superintendent. Mr. Brooks' new duties are in connection with the financial work of the company, in which he will assist Vice-president Walter S. Gifford.

G. E. Armstrong, protection engineer for the Southern California Edison Company, has joined the editorial staff of the McGraw-Hill Company as associate editor of the *Journal of Electricity*, San Francisco, Cal. In this capacity Mr. Armstrong will also assist Robert Silbley, the Pacific Coast editor of the ELECTRICAL WORLD and *Electrical Merchandising*. Since leaving the University of California, which he attended as a member of the class of 1914, Mr. Armstrong has been engaged in various engineering activities of the Southern California Edison Company and has acquired a wide experience in matters pertaining to hydro-electric generation of long-distance transmission of electrical energy.

Richard H. Rice, acting manager of the Lynn (Mass.) Works of the General Electric Company for the past year and a half and one of the best known steam engineering experts in the country, has been appointed manager of the Lynn plant, succeeding Walter C. Fish. Mr. Rice was born at Rockland, Me., in 1863 and was graduated in mechanical engineering at the Stevens Institute of Technology in 1885. After a short term of service in the institute laboratories and in the Dennison (Ohio) shops of the Pittsburgh, Cincinnati, Cleveland & St. Louis Railroad he entered the employ of the Bath (Me.) Iron Works as a designer of marine engines. From 1887 to 1891 he was designer and chief draftsman for the late E. D. Leavitt, consulting steam engineer, Cambridgeport, Mass., and from 1891 to 1894 he was superintendent and engineer of the William A. Harris Steam Engine Company, Providence, R. I. For the next nine years he was treasurer of the Rice & Sargent Engine Company, Providence, R. I., and in 1903 he was appointed consulting steam engineer for the General Electric Company, in charge of the steam-turbine department of the Lynn Works, which post he held until his appointment as chief executive of the Lynn factories. Mr. Rice has taken out about fifty patents on steam, air, water and other machinery, and he is a member of the American Society of Mechanical Engineers and has contributed to various engineering publications. The employee representation plan at Lynn has been developed largely under his administration.

R. H. RICE

Donald I. Cone, who took an important part in research work for the joint committee on inductive interference, whose valuable report has just been published by the California State Railroad Commission, is one of the energetic younger electrical engineers in the West. The labors of the committee with which he was associated are particularly important because of the necessity for solving complex problems arising from the long-distance transmission of high-voltage electrical energy on the Pacific Coast. Mr. Cone, through his experience with the transmission and protection engineering staff of the Pacific Telephone & Telegraph Company, San Francisco, was highly qualified to assist in laboratory and field work connected with the investigation. Mr. Cone was born at Eureka, Cal., July 30, 1891. He received his technical training at the University of California, where he was graduated from the College of Electrical Engineering in 1913 with the degree of B. S. Entering the employ of the Pacific Telephone & Telegraph Company, he has had charge of much of the study of interference and protection work for that system.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

WHAT HAPPENS WHEN INCREASES ARE PASSED ON

Where Discounts Are in the Neighborhood of 50 per Cent to Jobber List Prices Must Be Advanced by Twice the Net Advance on the Part

Advances in the price of raw materials are not always reflected in proportionate or equal amounts in the higher prices of the finished products. An interesting case of this came to notice just recently. The fractional-horsepower motors used in washing machines advanced in the neighborhood of $2.50 apiece. The manufacturer, in order to pass this increase on without making a cent of profit himself, found it necessary to advance the list price of his machine $5. In other words, the jobber gets his discount from the list price of the entire machine. Inasmuch as most discounts on socket appliances sold to the jobber are in the neighborhood of 40 to 50 per cent, it is apparent that any increase in the price of raw materials passed on must raise the list price at least double the amount of increase of the parts. Where the discounts are smaller, as in the case of equipment and certain supplies, then of course the increase in the price of the finished products is only a little more than the increase in the price of the raw materials or parts.

YEAR'S LIGHTNING-ARRESTER BUSINESS SHOWS INCREASE

Season Has Been Prolonged by Heavy Fall Buying While Shipments Are Made in Reasonably Short Time

Regardless of the time of year, reports from manufacturers of lightning arresters indicate that during the past fall sales have been rather large. Current business is increasing, while sales for the month of October were especially high. In one case sales during that month were almost equal to those during the past spring and summer months and were about 100 per cent greater than for the same month in 1918. Another manufacturer sold at least 50 per cent more in October than in any previous month of last year.

Although it has not been possible to get figures from all manufacturers, it is generally agreed that 1919 sales will exceed those for 1918. Some reports have been received showing increases in sales of from 17 to 32 per cent over the previous year. In one case this increase has come entirely in the last six months.

Deliveries are good and run from stock to six weeks. In one case they are given as good or bad, depending on the kind of product, with the expectation that in 1920 they will be good. Where stock cannot be accumulated, shipments are running up to six weeks, depending upon the requirements of the customer and the voltage ratings of the arresters. Even six weeks is considered rather short time for filling orders. One manufacturer who can fill orders in from ten days to two weeks has been materially assisted in this by the standardization of the product and a large stock of raw materials.

It is not expected that any increase in price will come into effect within the near future. Advances in the neighborhood of 15 per cent in the past six months have been reported on account of increasing prices of labor and materials.

Increased business is looked for in view of the general business outlook and some new power and line developments. The future seems much brighter than the immediate past because it is believed that most companies now have more time and more money to devote to the question of lightning arresters than under conditions prevailing a year ago. At the same time, one manufacturer finds that the smaller utilities are buying more equipment. Taken all in all, the lightning-arrester season has been extended beyond normal, and increased business for the whole year has been satisfactory.

TO GATHER CURRENT SUPPLY DATA FOR EXPORTERS

Commercial Agents of Bureau of Foreign and Domestic Commerce Will Collect Answers to Questionnaire Just Drafted

Because of the numerous inquiries from exporters regarding the characteristics of current supplied by power plants in various parts of the world, the Bureau of Foreign and Domestic Commerce, through the American consuls and commercial attachés, is undertaking to gather such information so that it may be available for American exporters.

P. S. Smith, electrical trade commissioner for the Bureau of Foreign and Domestic Commerce, has drafted a questionnaire which, when filled out, will supply the exporting electrical goods trade of this country with necessary information regarding electricity-supplying companies in all parts of the world. Among the data which will be available will be whether the current supplied in any foreign city is direct or alternating, the frequency of the current and the voltage.

The questionnaires will be forwarded to the commercial agents of the bureau, who will collect and return the information to the bureau in Washington, where it will be collated and classified.

FOREIGN EXCHANGE RATES AFFECTING ELECTRICAL EXPORTS

Record for Month Is Below That of October, but Total for Eleven Months Is 50 per Cent Over 1918 Period

Electrical exports for the month of November, amounting to $6,704,184, fell below the figure for October by $500,000, and in only two months of 1919 were total exports lower. High exchange rates undoubtedly have had considerable to do with this condition of the last few months. The figures are only half a million above those for November, 1918.

Total exports for the eleven months ended November amounted to $82,424,051, which, however, exceeded the same period of 1918 by an amount totaling just in excess of $27,600,000.

In no instance does any item exceed that of any other month in 1919, although exports of dynamos or generators and of carbon lamps in November were exceeded in only one month. On the other hand, fewer carbons were ex-

ported, and tungsten lamps, meters and transformers were next to the lowest of any month of 1919. Motor exports held up very well. The amount of insulated wire which left the country has been increasing steadily for the past three months.

Canada, France, England, Argentina and Japan have bought well throughout the month, and Italy, Cuba and Norway purchased in rather fair amounts.

Figures in the following table were computed by the Bureau of Foreign and Domestic Commerce:

	November		Ten Months Ended November	
	1918	1919	1918	1919
Batteries	$350,162	$406,722	$2,945,116	$5,521,235
Carbons	211,191	61,971	1,461,573	1,290,819
Dynamos or generators	300,230	617,981	3,019,315	5,216,860
Fans	35,307	68,298	758,649	1,388,512
Heating and cooking apparatus	54,617	117,772	611,545	1,469,182
Insulated wire and cable	398,956	535,746	5,138,426	8,315,897
Interior wiring supplies, including fixtures	153,310	174,640	1,328,345	2,074,064
Arc lamps	274	1,904	14,011	15,805
Carbon-filament lamps	14,845	41,501	89,063	185,912
Metal-filament lamps	423,533	253,963	3,139,289	4,363,009
Magnetos, spark plugs, etc.	260,796	237,604	2,431,700	2,802,013
Meters and measuring instruments	219,620	156,655	1,765,614	2,663,352
Motors	925,171	1,003,864	7,561,981	9,857,437
Rheostats and controllers	63,048	40,655	260,907	478,924
Switches and accessories	206,828	229,941	2,043,514	3,348,752
Telegraph apparatus, including wireless	51,767	37,147	310,716	789,120
Telephones	188,429	373,610	2,565,548	3,453,175
Transformers	554,116	157,381	3,333,493	3,489,982
All others	1,765,052	2,186,829	16,015,740	25,700,001
Total	$6,177,252	$6,704,184	$54,794,545	$82,424,051

STOCKS OF INDUSTRIAL LIGHTING REFLECTORS LOW

Activities Are Increasing in This Market, the Field for Which Offers Great Possibilities to Electrical Distributers, According to a Recent Survey

That the industrial reflector business has a favorable outlook for the new year is shown by the increasing demand, particularly in the Middle West and New England, and the growing interest of the jobbers, who are adding to their sales staff men to specialize in general and industrial lighting. The field open to this branch of the industry is covered in a report of a recent survey of industrial lighting carried on by the National Lamp Works.

Purchases of standard R. L. M. reflectors have increased this fall and winter, with more attention to the sizes from 100 watts through 200 watts. In consequence, stocks of these sizes in manufacturers' and in disbributers' hands are extremely low. This condition has been accentuated by the steel and coal strikes. The supply of sheets is low and deliveries are delayed in reaching the reflector producers. This is putting off shipments of the finished reflectors as far along as the first of March, or six weeks, although in general three to four weeks is ruling on a large order. Some manufacturers have small stocks and can ship two hundred or so in less than three weeks. These periods are about double those required early in the fall. In the last two weeks there has been more activity in the larger sizes around 400 to 750 watts.

Prices showed an increase during the first half of November of from 10 to 15 per cent.

One of the heaviest shortages in steel at the present time is in sheets. The automobile trade presents a factor which must not be overlooked when thought is taken on the supply of sheets. Unfilled steel orders at the end of December were the heaviest of the year, but it is expected that sheet capacity will be increased in 1920. Nevertheless, the necessity is apparent for anticipating sheet needs in 1920 and placing orders sufficiently in advance of requirements to insure delivery.

In connection with the work to be done in this industrial lighting field, the report previously mentioned brings to light some interesting figures. The average proportion of work done under artificial light is from 25 to 30 per cent, and the general manager was shown to have the greatest interest and authority in lighting changes. Of particular interest is the attitude of industrial manufacturers toward their present lighting. Although 30 per cent of the 446 manufacturers interviewed have not changed their lighting within five years, 85 per cent were more or less satisfied with their present lighting conditions. The latest change in 60 per cent of the plants was in lighting equipment and lamps, while in 31 per cent it was in lighting system. New Mazda B lamp installations predominated over Mazda C lamp installations in the ratio of 70 to 54 in these changes.

No reflectors were used in 19 per cent of the plants, and only 31 per cent were partly equipped. The size of plants concerned is indicated in the average number of lamps used, namely 1250. Renewals were slightly under a year. A small majority ordered lamps in less than 100 lots, 28 per cent in lots from 100 to 200 and 20 per cent in quantities over 200. Apparently plants do not know how to order lamps. When they do purchase they go to the lamp manufacturer for 8 per cent, to the electrical jobber for 43 per cent, to the electrical retailer for 34 per cent and to the central station for 18 per cent. Hence is shown the importance of the electrical jobber and retailer in the distribution of lamps to industrials, and the opportunity of those agencies of working with the plants which they serve in illumination matters.

The industrials state that they would seek information regarding lighting changes from the electrical retailer, jobber, architect or engineer, central station, their own electrician and the lamp manufacturer in that order, so that approximately 70 per cent would go to the electrical distributer or to their own organization. And they are keen to the advantages to be derived from efficient industrial lighting when 79 per cent figure it would increase production, 71 per cent believe it would decrease spoilage, 60 per cent hope for prevention of accidents, 51 per cent believe it would improve discipline and 41 per cent see an improvement in hygienic conditions. The lamp distributer and the service to be rendered by efficient lighting conditions in the factory seem to go so closely hand in hand that an especially bright outlook appears in the industrial reflector market.

UNDERWRITERS' APPROVAL OF FARM-LIGHTING PLANTS

Manufacturers Decide, After Weighing Advantages and Disadvantages, that Decision to Submit Plant Must Rest with Individual Concern

There has been more or less discussion recently relative to the advisability of obtaining from the Underwriters' Laboratories approval of farm-lighting plants. In order to arrive at a decision on this matter a committee of manufacturers gave it consideration and as a result stated that approval is advantageous on the grounds that it is a guide to perfect design and makes the product as safe as possible; that it prevents increase in insurance rate with stock companies in some districts, though it does not decrease rates as much as should be the case with a device that eliminates the dangers of lighting systems of the flame type, and that, besides, it offers some sales advantages. On the other hand, the committee thought there were numerous disadvantages, among them being that to obtain the underwriters' approval retards the development of original ideas and encourages extreme requirements in construction which tend to increase the cost beyond commercial limits. It is a disadvantage, the committee held, to have fire underwriters' requirements cover structural details instead of confining them to fire-prevention principles.

As a result the Association of Farm Lighting Plant Manufacturers, at its recent meeting, concluded that the individual manufacturer must decide for itself whether or not it shall submit its plant for approval by the Underwriters' Laboratories.

METAL MARKET SITUATION

Copper Situation Strong in Market of Light Trading—Lead Again Higher

Producers of copper are holding spot and first-quarter deliveries at 19.25 cents and, in the main, second-quarter at 19.50 cents a pound. At the same time, some of these producers are willing to pull first-quarter quotations over into April and even May for regular customers on large orders. The market is much quieter than during the first two weeks of the month, and spot and nearby requirements of the large consumers are well taken care of. Producers, considering this situation, see no reason for letting down the bars to encourage the little spot and nearby business that is coming through. It is felt that only a few weeks will pass before the big consumers will be in the market again. Meanwhile there is an intermittent flow of orders for small amounts of the metal. At present there are no signs in the market of a lower copper price in the near future.

The outside market, on the other hand, will shade 19.25 cents, even to 19 cents a pound, but the amount of business done at this figure is small. Traders are buying and selling among themselves at this figure, in many cases to fill obligations. If sales should continue as they did in December and early January, producers' stocks of refined metal and their capacity for refining would be severely taxed to meet the demands. Refiners have lowered their capacities and are still running at a good rate, but if customers as a whole begin to send in orders on a big scale for rather nearby shipment, refining capacity would be unable to handle the business. With no evidence of a drop in sight, customers knowing their requirements over the next few months gain nothing by holding off till the last minute, tending to clog up refining capacity on a specified shipping schedule.

Export demand has quieted down considerably, the ruling price being 20 to 20.25 cents. Of the copper exported from the United States in 1919, it is estimated that Japan took 40 per cent. The outstanding fact is that Japan is becoming an importer of copper rather than an exporter. This is an entire reversal of her policy of a few years ago. Much of her copper has been turned into brass goods for the Eastern market, while at the same time she has been drawing bar into wire for the modernization of her factories and for hydro-electric developments.

Lead shows an advance over the previous week. The main producer's price is 8.50 cents, while the outside market has small supplies at 8.75 cents.

Zinc for early shipment is not very plentiful. Better inquiries are around from the galvanizers. Sheet zinc is higher to 12.50 cents.

Steel-mill conditions are not very favorable in light of short coal supplies and lack of sufficient labor. Finished and semi-finished material producers are unable to secure adequate supplies of raw materials and are consequently limited in their output. This has a distinct bearing on the supply of sheet steel and other kinds of steel and iron needed by electrical manufacturers.

NEW YORK METAL MARKET PRICES

	Jan 13	Jan. 20
Copper:	£ s d	£ s d
London, standard spot	119 15 0	116 5 0
	Cents per Pound	Cents per Pound
Prime Lake	20.00 to 20.50	19.50 to 20.00
Electrolytic	19.25 to 19.50	19.00 to 19.25
Casting	19.25	18.50 to 18.75
Wire base	22.25	22.25
Lead, trust price	8.25	8.50
Antimony	10.25	10.62½
Nickel, ingot	42.00 to 43.00	42.00 to 43.00
Sheet zinc, f.o.b. smelter	12.00	12.50
Spelter, spot	9.50	9.50
Tin	65.00	64.00
Aluminum, 98 to 99 per cent	31.50 to 32.50	31.50 to 32.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	17.75 to 18.25	18.00 to 18.25
Brass, heavy	10.50 to 11.00	10.50 to 11.00
Brass, light	8.50 to 8.75	8.75 to 9.00
Lead, heavy	6.75 to 7.00	7.00 to 7.12½
Zinc, old scrap	5.25 to 5.50	5.25 to 5.50

THE WEEK
IN TRADE

A HIGH rate of buying continues in all localities but the Northwest, in which section the midwinter lull has not yet been overcome. Here, however, business is picking up. Building is progressing at a great rate, several returns showing improvement over the same period a year ago.

Complaints on slower and more unsatisfactory shipments are coming in, and jobbers' stocks are suffering, particularly in the West and New England. Deliveries on sockets are so much better that competition is lowering prices a bit. Loom is in a little better shape, too, as far as deliveries are concerned.

Greater activity is reported in the central-station market for apparatus. In Chicago jobbers are adding salesmen, principally to handle appliances, and are increasing their office and storage space. Appliance sales are still extremely heavy, and no let-up is foreseen. More attention is being paid to orders far in advance of those ever placed before. Collections are, in general, good.

Price advances are shown on high-tension porcelain insulators and accessories, some lines of single-phase and fractional motors, one type of pole lightning arrester, sewing machines, bells and buzzers and cross-arms. In the West knife switches and safety switches, condulets and friction tape are up. Jobbers' prices are higher on flexible armored conductor.

NEW YORK

Continued heavy buying keeps a large volume of material constantly on the move. There is no sign of a let-up on wiring supplies to afford any accumulation of stocks. Jobbers' pipe stocks are long and short, depending on the jobber and whether or not shipment has just come in. Frequently pipe stocks never reach the warehouse but are routed from terminal to customer. The same can be said of non-metallic flexible conduit and flexible armored conductor. Much of this material is booked for three months ahead. Shipments of loom are said to be coming through a little better. One jobber has a good stock of open wiring porcelain and little call for it, but the general market for this is much undersupplied.

Central stations are ordering transformer voltage and feeder regulators, meters and lightning arresters in better volume than is customary at this season. Distribution-type transformer stocks are better than a month ago, but motor stocks in local warehouses are badly broken up.

As for recent price advances, high-tension insulators, bushings and accessories went up 5 and 10 per cent, depending on type. Certain single-phase and fractional motors went up 5 and 10 per cent, one class of pole-type lightning arresters advanced 17 per cent, and some jobbers' prices on flexible armored conductor are higher. Shipments of material from factories are expected to become longer rather than shorter.

One jobber reports a small shortage on nearly all recent incoming shipments. In some cases part of the shipment is missing while in other cases a component part of the apparatus never was packed originally.

MOTORS.—Westinghouse type AR single-phase motors advanced 10 per cent in price on Jan. 12 and General Electric fractional-horsepower motors advanced 5 per cent on Jan. 15. New York stocks of motors are spotty, and incoming shipments are quickly absorbed. Ability to ship is clinching the orders.

TRANSFORMERS.—Local stocks are in better condition than a month ago. Central stations are ordering well.

LIGHTNING ARRESTERS.—Sales are in good volume. Certain pole types have advanced 17 per cent because of increase in price of porcelain parts used in their make-up. One manufacturer reports better ordering of arresters with transformers, as a component accessory of every distribution pole-type transformer.

METERS.—Heavy ordering is the characteristic note in a normally rather quiet market at this season. No relief to present shipments is offered by manufacturers.

LAMPS.—Stocks are reported somewhat below normal, especially on the 120-volt size.

RIGID CONDUIT.—Jobbers' stocks are spotty, running from one-half carload in warehouse up. Manufacturers' local stocks are likewise, as a rule, poor. Black pipe in ½-in. size is selling for $68 to $74 for 1,000 ft.

FLEXIBLE ARMORED CONDUCTOR.—Jobbers' prices are higher in several cases. For 1,000 ft., No. 14 double strip is up to $95, while other quotations are as low as $88, with virtually no stock. Some jobbers' allotments are booked ahead for three months.

NON-METALLIC FLEXIBLE CONDUIT.—Somewhat better deliveries are coming in, but orders are taking up the goods so fast the loom is frequently transshipped without touching the stockroom. From list to 25 per cent off is being quoted, depending on amount—the latter figure for coil lots.

WIRE.—No. 14 rubber-covered is commanding $12.50 to $13 for 1,000 ft., while 5,000-ft. lots can be had for $11.50. Stocks are in fair condition.

PORCELAIN.—High-tension pin-type insulators and suspension insulator accessories advanced 10 per cent in price Jan. 17. Suspension-type insulator bushings and hardware advanced 5 per cent. The market is strong with heavy buying and many inquiries and shipments are long. From sixty days to twelve weeks is being quoted, depending on type wanted, and the tendency is toward still longer shipments.

CHICAGO

Jobbers in the Middle West are in general putting on more salesmen and taking more office and storage space. Many of them are enlarging their forces in order to push the sale of household appliances, particularly washers. On account of poor factory deliveries in many lines large increases in sales are not expected immediately. Central stations all over this section of the country are planning or building new plants, substations and lines. The Commonwealth Edison Company has drawn plans for a large new plant to serve the Calumet district.

Prices have advanced approximately 10 per cent on high tension insulators and electric sewing machines.

WIRE.—Base prices on weatherproof are lower, averaging about 28 cents. Rubber-covered still holds 29 to 30 cents. Shipments are improving, but stocks do not get a chance to build up much.

ARMORED CONDUCTOR.—There is a very short supply to meet the existing big demand. Prices are stiff. No. 14 twin is quoted at from $87 to $95 per 1,000 ft.

SOCKETS.—A big demand is noted and stocks are fair with the exception of pulls, which are still low. In standard package lots these are quoted at 54 cents, keyless at 27 cents and key and push at 30 cents.

BUZZERS AND BELLS.—A price increase of approximately 10 per cent has been put into effect. The difficulty of getting small wire is probably accountable for the shortage of buzzers.

HIGH-TENSION INSULATORS.—At least two large manufacturers of insulators have increased their prices approximately 10 per cent. Quotations from one maker at the increased prices are as follows: 15,000-volt, pin-type, 91 cents; 32,000-volt pin, $2; 45,000-volt pin, $2.30. The pins for the insulators cost 25 cents, 85 cents and 90 cents respectively. The link type of suspension insulator sells for about $3.25, and the regular type, 10 in., at $2.60.

SEWING MACHINES.—Price increases have been made on several electric sewing machines, amounting to about 10 per cent of the list. A Wilson machine advanced $7 to $72 Jan. 1, and one Westinghouse model increased about a month ago $7.50 to $72.50.

BOSTON

Great activity characterizes trade. Building and engineering construction permits are running far ahead of last year. Jobbers' stocks are hampered by rather poor deliveries, but regular customers are being well cared for by individual houses. Collections are holding up well. A number of central stations have been in the market for high-voltage cable during the past week, and a fair amount of extensions of lines for ordinary service is expected this spring. Prices are steadier this week than for some time, and a decided softening is noted in socket quotations, owing to competition. Domestic ap.pliance sales are a continuing feature of the market. In the main, supplies of the staple character are harder to obtain than specialties. The New England Telephone & Telegraph Company has begun the erection of a three-story exchange building with provision for machine switching in Boston.

WIRE.—Prices are fairly steady, tending toward firmness, with varying discounts under close competition. Three central-station orders placed within a few days for three-conductor, 13,000-volt to 17,000-volt cable totaled about $75,000. Base prices range as follows: Bare, 23.5 to 24 cents; rubber-covered, 26 cents net; weatherproof, 28 to 28.5 cents. Stocks of smaller wire are much improved, and not much complaint is heard about deliveries.

FLEXIBLE ARMORED CONDUCTOR.—Jobbers are serving their "regular" customers better than for some time, though not much of this material is lying around loose. No. 14 single-strip was quoted at about $90 per 1,000 ft. Monday.

METALLIC FLEXIBLE CONDUIT.—The demand is great but the supply is very low. In the small lots available list prices are being quoted on both single and double strip.

NON-METALLIC FLEXIBLE CONDUIT.—Scattering shipments are coming in, and the "old line" customers are being cared for fairly well by small-lot sales. The $\frac{7}{32}$-in. size brings about $30 per 1,000 ft.

SOCKETS.—Prices reflect close bidding, with improved supplies. Pulls are running lower at 45 cents, keys at 25.5 cents, and keyless at 23.5 cents in case lots. A healthy demand continues.

SNAP SWITCHES.—Trade is good, with fair supplies and discounts of about 15 to 17 per cent off list.

STORAGE BATTERIES.—Business is very active, but supplies are well maintained by advance ordering. Prices are steady, notwithstanding recent upward quotations in lead. A demand is arising for the use of storage batteries in improved truck lighting and ignition work. Deliveries are quoted from two to three weeks for this service.

STARTING, LIGHTING AND IGNITION SYSTEMS.—A tremendous business is being handled. One manufacturer is reported to have sold his entire year's production within the first eight days of January and to have closed his books on further orders at present.

MOTORS.—Deliveries on moderate-sized and small single-phase and three-phase motors are quoted at 12 weeks, f.o.b. factory. Local stocks of motors are hard hit. Even concerns which do not cater to appliance trade are approaching the point of overtaxed facilities. Confectionery plants are buying heavily in motors at present.

DRY CELLS.—The demand is falling off somewhat, with steady prices. No. 6 cells are quoted at $32.90 per 100, and the igniters at $33.90, in barrel lots.

RIGID CONDUIT.—Local stocks are relatively small in the smaller sizes and could be quickly cleaned out if released to the general trade. One jobber reported 50,000 ft. of ½-in. galvanized pipe in stock Monday, with scheduled shipments of two carloads a month to September.

ATLANTA

Jobbers report a continued increase in activities after the inventory period. Unusually large orders are being received from all parts of this section, and there is a tendency on the part of some purchasers to place orders for their 1920 fall requirements. One jobber reports that parties who formerly ordered a dozen articles at a time are now placing orders for a gross of the same, not with the idea of getting a pro rata share of the gross but with the hope of receiving all of their order.

January building permits started off with a tremendous rush, the first ten days of the month smashing all previous January records. Building permits for the city of Atlanta amount to $986,390 and cover such construction as large department stores, apartment houses and warehouses. The week ended Jan. 8 showed in the six principal cities in the South an average increase in building of 60 per cent over last year. Jobbers report collections unusually good.

CONDUIT.—No improvement is to be noted in stocks or shipments.

WIRE.—Stocks and shipments of weatherproof continue to improve, and jobbers are making good shipments on all of the large sizes, while Nos. 6, 8 and 10 are reported in sufficient quantities to take care of present demands. There is a shortage, however, in No. 12 and No. 14 rubber-covered. Prices are quoted steady; rubber-covered, 28 cents; weatherproof, 29 cents base.

CROSS-ARMS.—An advance of 20 per cent in price is noted. Local stocks are in fair shape and shipments good.

HEATING DEVICES.—Jobbers report the receipt of large orders, many of which are placed for the retailers' 1920 holiday trade. Orders for all lines are phenomenal, flatirons, as usual, showing the strangest demands. On account of the anticipation of their future requirements jobbers seem to feel that they will be able to take care of the coming summer and fall without difficulty.

DESK FANS.—The spring activity is somewhat late this year, no orders of moment yet being received. In anticipation of the demand beginning about Feb. 1, jobbers are accumulating large stocks so that they will be in a position to make prompt shipments when the trade begins.

SEWING MACHINES.—The popularity of the portable machine is on the increase. A brisk movement is being reported by the principal jobbers. Fair shipments and good local stocks account for their ability to fill orders.

WASHING MACHINES.—The demand continues to exceed the supply, and slow shipments indicate that no improvement is to be expected.

EXHAUST FANS.—Contrary to the usual custom, the movement of exhaust fans is continuing throughout the winter. The spring demand, however, is not yet in evidence, but jobbers anticipate considerable activity in this line in the next few months. They are therefore making every effort to accumulate sufficient stocks.

ELECTRIC HOISTS.—A temporary slump in demand since Jan. 1 is noticed. Numbers of inquiries are beginning to come in, and as soon as manufacturers have completed their 1920 plans this item will become active.

SEATTLE-PORTLAND

Business in Seattle and the Puget Sound district last week was at low ebb, in spite of the fact that building showed a slight spurt. The small volume of sales is directly attributable to the decline in steel-ship building, which also affects smaller allied industrial plants, such as machine shops, boiler shops, tin and copper shops, etc. Sales to lumbering and logging industries also are at a minimum, because many plants are closed or will close on account of the continued car shortage. Jobbers' stocks in many lines, especially motors and heavier power apparatus, are hard hit, and chances for immediate replenishment are slight. Stocks of schedule material are in fair shape and are improving, owing primarily to the light demand since before the holidays. Shortage of household appliances, particularly washing machines, vacuum cleaners, hot plates, etc., according to several larger jobbing houses, is causing considerable alarm, as promised shipments are not coming through. Prices, with but few minor exceptions, remain comparatively firm. Collections both in the city and rural districts are good, though not up to the standard of last year at this time. The Seattle school board recently decided to postpone the issuance of $4,500,000 in bonds for proposed new schools until costs are lower. The City Council is considering a bond issue of $1,750,000 for completion of the Cedar Falls hydro-electric project. Machinery and equipment for this project would cost $500,000 and would increase the capacity of the plant to 18,000 kw. The Kane Pneumatic Shock Absorber Company, Centralia, Wash., plans the erection of a 500-kw. power plant.

Portland district reports business showing a gradual increase following the holiday lull, particularly in appliances, small motors, house-wiring devices, etc. Shortage of stocks in many lines of household devices is acute with no immediate relief. Building both in Portland and in the smaller towns is increasing noticeably. Prices have shown no recent advances. Collections throughout the state, and in Portland particularly, are considered good.

ELECTRIC PADS.—Several of the largest Seattle retailers report stocks sold out. The local factory is unable to keep up with orders and Eastern shipments are coming through very slowly.

WIRE.—In spite of the light demand of recent weeks, stocks as a whole are poor.

FLEXIBLE ARMORED CONDUCTOR.—Slight increase in demand is noted, occasioned primarily by minor increase in apartment-house construction, which is scheduled to show further increases. Despite poor shipments, stocks are in fair shape.

SAN FRANCISCO

There is plenty of building going on, but few new jobs. Credits are being extended on a shortened basis because the sale of devices, which necessitated longer credit for a time, is now firmly established and dealers no longer need extra time on washing machines and the like. Collections average forty-five days' time, which is considered a good showing.

RECEPTACLES.—The sale of baseboard receptacles is being stimulated by the remarkable demand for portable stand lamps, and dealers are encouraged to believe that this long-pending demand will now relieve the much overloaded socket.

SWITCHES.—The call for knife switches is increasing, and especially for double-throw switches, which are needed in range and water-heater installations. Rumors are in circulation that several range campaigns are to mature, requiring the use of double-throw switches. Standard knife switches have increased 20 to 25 per cent in price in various quantities, and externally operated safety switches have jumped from 5 to 15 per cent in various quantities.

CONDUIT FITTINGS.—Condulets, taplets and parallel lines have increased in price 20 per cent right down the line through the various quantities. Several jobbers report that their 1919 sales showed a big increase over 1918, one which was even greater than the proportionate increase on outlet fittings.

INSULATING MATERIAL.—Commercial grade friction tape has increased 15 per cent in various quantities, the ¾-in. size now selling for about 47.5 cents per pound in 100-roll lots. There is a bigger demand for higher grade friction tapes, no doubt occasioned by the steady increase in the price of commercial grade which has brought the two grades almost together on a price basis.

RANGES.—It is reported that a big range campaign will shortly be staged by one of San Francisco's power companies. It is a fact that without any special effort the demand for ranges has continued without regard to increase of prices, showing that the public has acquiesced in the factory contention that high labor costs have justified these increases.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Cut-outs

A line of cut-outs with white porcelain bases and heavy copper current-carrying members has been recently developed by the Ward Electric Company, Philadelphia Stock Exchange

TWO-WIRE SINGLE-BRANCH CUT-OUT

Building, Philadelphia, and approved by the Underwriters' Laboratories. The line includes catalog numbers 2569, 2965, 2587, 2199, 2165, 8042, 2135 and 1935. The last-named is illustrated, being a two-wire single-branch cut-out.

Mechanical Milk and Cream Producer

For producing cream and milk mechanically from their component parts the Sharples Separator Company of West Chester, Pa., is manufacturing a 200-gal. (757-l.) motor-driven emulsifier.

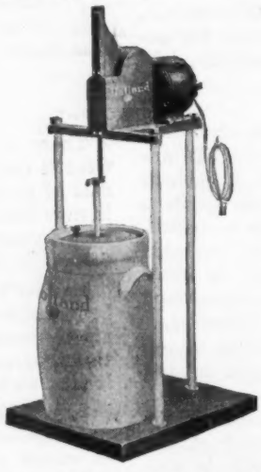
A 3-hp. motor with a speed of 3500 r.p.m., equipped with a 9-in. (23-cm.) steel pulley, drives the emulsifier bowl by means of a canvas belt at a speed of 16,000 r.p.m. Where the emulsifier is to operate on direct current an "Eck" motor, equipped with a Cutler-Hammer rheostat, is supplied, and where alternating current is available a three-phase, 60-cycle motor, rated at 220 volts, is used without a controller.

SUPPLIED WITH HEATER TANK, BRINE TANK AND COOLER

Besides the emulsifier proper a copper water-jacketed heater tank with a propeller agitator, a brine tank and pump and a cooler are supplied with the outfit; the brine pump and agitator are operated from a line shaft.

Butter Churn with Inclosed Mechanism

Sanitation, safety, silence and ease of operation, portability and simplicity are characteristics which the Holland Manufacturing Company of 129 North Wells Street, Chicago, states have been built into its motor-driven household-size churn. This churn consists of a $\frac{1}{12}$-hp. electric motor and driving mechanism mounted above a double-glazed 5-gal. (18.9-l.) stone jar in which a rod and dasher of the familiar hand-churn type is operated. The wood



HAS ROD AND DASHER MOVEMENT

base of the churn supports three iron uprights to hold the motor and gear case and also keeps the earthenware container in place.

This new outfit for home butter-making, which operates on 110 volts alternating current or 32 volts or 110 volts direct current, weighs 60 lb. (27 kg.).

Electrically Operated Automobile Valve Grinder

An electrically operated grinder for automobile valves has been placed upon the market by the Eclipse Valve Grinder Company, Sub-Freight Station Building, Twentieth Street at Oak, Kansas City, Mo. It is designed to give a positive and rapid back and forward, or oscillatory, movement to do the grinding and a slow rotary movement to turn the valve continually to a new position. The motor, which is controlled by a trigger switch in the handle, operates on either alternating current or direct current from the ordinary 110-volt lighting socket.

One feature of the new valve grinder is its light weight, which is but 6½ lb. (2.9 kg.). Other features of the tool pointed out by the maker are simplicity

MOVEMENT OF VALVE GRINDER IS BOTH OSCILLATORY AND ROTATING

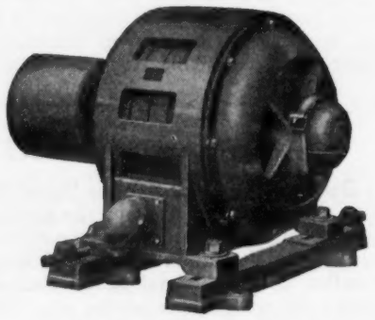
of operation and limited number of parts.

The motor housing is constructed of tough aluminum alloy made in two compartments, thus separating the grease-packed mechanism from the motor.

Constant-Speed, Ring-Oiling Induction Motors

Standard horizontal type, constant-speed, ring-oiling induction motors for operation on two-phase and three-phase circuits on 110, 220, 440, 550 and 2,200 volts and 60, 50, 40 and 25 cycles are now being marketed by the U. S. Electrical Manufacturing Company of Los Angeles, Cal., and are known as type "ST."

The frames of the new motors are cast and of shell-type construction with openings to allow air circulation. End brackets protect the windings and may be rotated for wall or ceiling mountings. Oil wells are protected from dirt and dust, and the inside of the bearing housings are enameled. Oil-well



SHELL-TYPE FRAME USED

level indicators are provided with hinged self-closing covers. Large replaceable bearings are used. Provision is made to keep accurately machined oil rings in place. Oil is dis-

tributed over the entire bearings, and double grooves on the end with multiple drains prevent surplus oil creeping along the shaft.

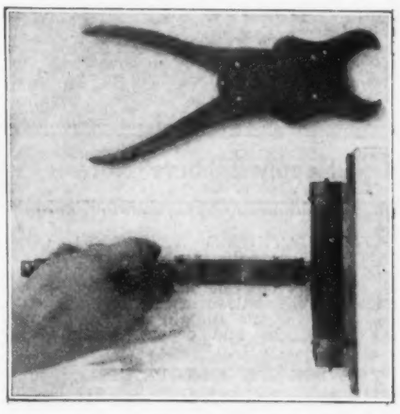
The stator, the manufacturer states, is made of non-aging electrical sheet steel, japanned, baked and stacked in a hydraulic press between heavy keys end flanges. End fingers and spacers are welded to heavy disks to prevent teeth bending in removing the rotor. The slots are practically all of open type.

The coils are form-wound, taped and in most sizes of either square or rectangular wire, cotton-covered. By removing specially treated wedges which hold the coils in place, these can be removed and readily replaced in case of burn-out. The insulation in the slot is laminated varnished cambric and fiberoid and is reinforced at the ends. In the 220-volt motors mica is used for slot insulation. Phase insulation is laminated varnished cambric in the small sizes of motors and specially insulated and treated phase coils in the larger sizes. The leads are extra-flexible double-braid brush cable extending through rubber bushings in the terminal plate.

The shafts of the rotor are stated to be of high-carbon open-hearth spindle steel and of large size. The bars are of drawn copper of rectangular cross-section. The rotor slots are overhung and the bars act as fans, providing forced air circulation. The end rings, it is claimed, have liberal cross-sections and radiating surface and are brazed to the bars, making an indestructible construction which, it is said, cannot be burned out. The rotor flanges are keyed to the spiders, which are used on all sizes of the motors.

Safety Cartridge Fuse Remover

For removing and replacing cartridge fuses ½ in. (12.7 mm.) to 1½ in. (38 mm.) in diameter the Bush Electric Company of Cleveland, Ohio, has



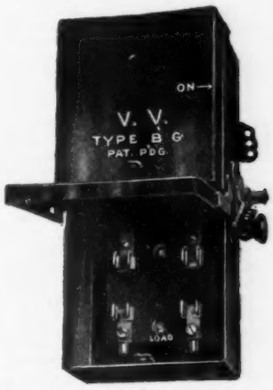
MADE OF NON-WARPABLE AND NON-MOISTURE-ABSORBING INSULATION

developed a safety cartridge-fuse remover. This tool is made of a special insulating material which is said to be extremely tough but which will not warp or absorb moisture. The construction of the fuse remover resembles that of a pair of pliers, except that the movement of the handles is multiplied in the gripping jaws, resulting in simplicity of operation, only one hand being required.

Quick-Make and Quick-Break Safety Switches

A compact externally operated quick-make and quick-break safety switch known as type BG and designed to possess all the safety features essential for maximum protection to both operator and the circuit which it controls has been placed on the market by the V. V. Fittings Company, 1910 North Sixth Street, Philadelphia, Pa.

The inclosing cabinet used in the new switch is made of sheet metal with electrically welded joints. The switch proper is toggle-spring-actuated, thus producing a positive "on" position and



SWITCH IN "OFF" POSITION AND FUSE COMPARTMENT OPEN

a positive "off" position. The springs are at rest when the switch is in either the "on" or "off" position. The knife blades, it is claimed, make and break contacts simultaneously. The fuse compartment of the new switch cannot be opened until the switch mechanism is in the "off" position, nor can the switch be thrown to the "on" position while the fuse compartment door is open. The switch compartment can be opened, if locked, only by authorized parties. This permits the inspection of the switch even while in the "on" position.

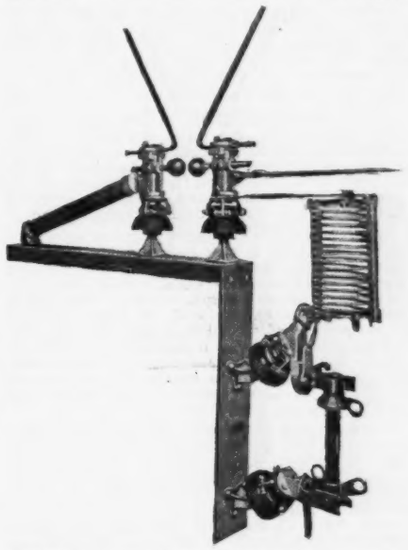
Provision is made for the use of from one to three locks on either the "on" or "off" positions of the switch, and both the switch and fuse compartment doors are fitted with hasps for attaching padlocks.

These safety switches are obtainable in both fuseless and fusible styles for 250 volts alternating or direct current and also for 500 volts alternating current. All of these switches are obtainable in 30-amp. or 60-amp. styles, two or three poles. In the 30-amp. size, it is stated, the regular 60-amp. switch is used with a 30-amp. fuse cut-cut to guarantee strength.

The finish of all switch boxes is baked black enamel.

Farm Line Switch and Arrester Unit

A farm-line unit combining an expulsion-fuse disconnecting switch, a sixteen-turn choke coil and a light-

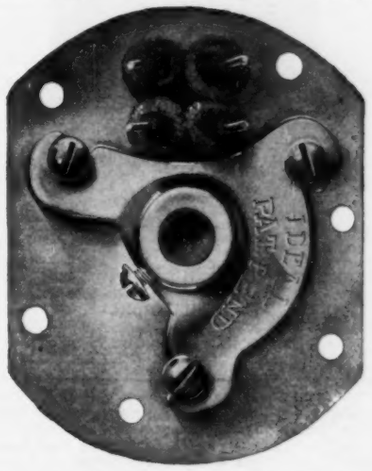


CONSISTS OF DISCONNECTING SWITCH, CHOKE COIL AND LIGHTNING ARRESTER

ning arrester complete with horn and ball gaps is being marketed by the Electrical Engineers' Equipment Company of Chicago, Ill. The entire equipment is mounted on two steel plates at right angles, ready for bolting to the cross-arms. It is made for a voltage of 13,200 in the "L" size and for higher voltages in the combination "G." All steel members are hot-dip-galvanized, while pins, bolts and nuts are sherardized. The outfit includes a switch stick and six extra fuse links.

Improved Outlet Plate

An improvement has been made by the Sterling Manufacturing Company, Erie, Pa., in its outlet plate whereby



FIXTURE STEM HELD FAST

the new hickeys will be provided with a set screw so as to hold securely the fixture stem, especially when used to support a wall bracket.

Manufacturers' Activities

THE BUSSMAN MANUFACTURING COMPANY, St. Louis, Mo., states that Buss renewable fuses from 3 amp. to 600 amp. at 250 volts and from 3 amp. to 60 amp. at 600 volts have been listed as standard by the Underwriters' Laboratories.

THE WOLVERINE TUBE COMPANY has moved into its new plant at 611-625 Central Avenue, Detroit, Mich. The new plant, comprising two and one-half acres of land with 30,000 sq.ft. of floor space in the factory, will afford greater facilities for producing brass and copper tubing.

THE SPERO ELECTRIC COMPANY announces that it has bought a building at East Thirty-third Street at Woodland Avenue, Cleveland, Ohio, and has remodeled it to suit requirements. The three floors and basement will be used for the manufacture of a full line of switchboards, tablet boards, fuse boards and cabinets. No new products are being manufactured. The personnel of the company consists of B. E. Spero, Leon Spero, S. W. Spero and A. F. Cibs.

THE FORT WAYNE (IND.) BATTERY MANUFACTURING COMPANY will as of Jan. 1, 1920, begin the manufacture of storage batteries for automobiles and lighting systems. The company is completing a two-story building, 54 x 196 ft., and a boiler house, 50 x 57 ft. The company has taken options on several vacant lots surrounding the plant for future expansion. Among the directors are S. A. Lehman, J. C Sherer and George Houser.

NEW VICE-PRESIDENT FOR WESTINGHOUSE INTERNATIONAL — Edward D. Kilburn, who since March 15, 1917, has been New York district manager of the Westinghouse Electric & Manufacturing Company, was recently elected vice-president and general manager of the Westinghouse Electric International Company. Mr. Kilburn was graduated from Cornell University, and immediately after leaving college he entered the employ of the Westinghouse company, being for a number of years with the Syracuse office of the company. Subsequently he was transferred to the Westinghouse Machine Company, with headquarters at New Haven, Conn. In 1915 he returned to the Electric company as manager of the power division of the New York office. A year later he was also made

E. D. KILBURN

manager of the railway and lighting divisions, subsequently becoming manager of the office. Maurice Coster, who has been engaged for more than thirty years in handling the foreign interests of the Westinghouse company, continues as vice-president of the International company with advisory duties. The Westinghouse Electric International Company was formed in the spring of the present year to succeed the Westinghouse Electric Export Company. It handles the Westinghouse foreign business and is worldwide in its scope, exclusive of the United States and Canada.

THE JANETTE MANUFACTURING COMPANY, Chicago, announces that it has moved into its new factory at 556-558 West Monroe Street.

F. O. CREAGER has been placed in charge of the Chicago office of the Adams-Bagnell Electric Company, which will in the future be at 1511 Heyworth Building, Chicago.

B. J. SHULSINGER has resigned his position with the McGraw-Hill Company, publisher of the ELECTRICAL WORLD, to become advertising manager of the National Metal Molding Company, Pittsburgh, Pa. Mr. Shulsinger was at one time a member of the advertising department of the Western Electric Company.

THE CHANDLER SERVICE CORPORATION, 74-76 Ashland Place, Brooklyn, N. Y., announces that the service formerly rendered by the Chandler Engineering Corporation will be continued under conditions affording the organization greater resources, more extensive facilities and broader scope for progressive, enterprising expansion along new lines in the industrial field. Its undertakings embrace the electrical art through its engineering and industrial divisions in connection with industrial projects, and it is equipped with laboratories, drafting rooms and experimental shops.

GENERAL ELECTRIC COMPANY TO OPERATE GLOUCESTER FACTORY—Plans of the General Electric Company to acquire the three-story Rowe building on Duncan Street, Gloucester, Mass., and utilize it as a factory for motors and generators were made public last week after a conference between company officials and the Municipal Council. The company holds a seven-acre tract in the city which will probably be developed, and at the end of three years, if plans mature, about 5000 persons will be employed in Gloucester.

THE ARNOLD ELECTRIC TOOL COMPANY, INC., 902 Chapel Street, New Haven, Conn., has recently increased its capital stock from $25,000 to $300,000 in order to provide funds for its greatly increased business. Until recently the company had its tools assembled, but the old Brown Street school has been purchased and converted into a manufacturing plant, to which an addition must be erected to meet the company's requirements. Over 200 mechanics will be employed to fill outstanding orders and to care for the 1920 business, which the company feels will be heavy.

PACENT ELECTRICAL COMPANY, INC., 150 Nassau Street, New York City, has been incorporated. Louis G. Pacent, radio engineer, who for the past five years has been manager of the radio department of the Manhattan Electrical Supply Company, Inc., is president. The new company will carry a full line of dependable electrical and radio apparatus for experimental work, and will also maintain a laboratory where such equipment, including the latest types of vacuum tube apparatus, can be treated under actual working conditions. All the most modern equipment will be sold through the various jobbers and dealers under full guarantees, and the company will co-operate with the American Radio Relay League in the testing and promotion of new developments in radio apparatus.

CHANDELIER SHOW AND FIXTURE MARKET IN DETROIT.—The National Council of Lighting Fixture Manufacturers will hold its chandelier show and fixture market at the Hotel Statler in Detroit, Mich., Feb. 9 to 14. After the preparation of displays and opening of registration booth on Feb. 9, the joint meeting with the Glassware Guild and National Lighting Fixture Dealers' Society will be held at 9:30 a.m. Feb. 10. At 10 o'clock that morning and thereafter each morning at 9:30 the National Council will meet, the session on Feb. 11 being given to design protection, E. N. Caldwell chairman; on Feb. 12, topic, standardization, chairman to be selected; on Feb. 13, election of officers, report of committees and selection of convention city, and on Feb. 14, executive and other committee meetings. The 10 a.m. session on Feb. 10 will be given over to cost accounting, Robert M. Biddle chairman. The 2 o'clock session each afternoon will be given over to the chandelier show and fixture market. The chandelier show at 7:30 p.m. on Feb. 11 will be architects and builders' night, and the one on Feb. 13 will be public night.

THE ODIN COMPANY, 325 West Ohio Street, Chicago, which has been manufacturing motor-driven electric washing machines for some time, is now under the direction of H. H. Lyche, president; W. H. Kenealy, vice-president, and J. J. Kenealy, secretary-treasurer.

THE GENERAL ELECTRIC COMPANY'S Windsor (Conn.) factory is to have its floor space doubled by the addition of about 40,000 sq.ft. The factory was purchased about fifteen years ago from the Eddy Electric Company, then in bankruptcy. About 150 employees will be added. Small motors and other supplies of lighter character are produced at Windsor, with Arthur A. Bailey as general manager.

FAIRBANKS TO DISTRIBUTE LINCOLN MOTORS.—A contract recently signed between the Fairbanks Company and the Lincoln Electric Company of Cleveland, Ohio, gives this company the exclusive distribution of Lincoln electric motors for industrial applications. This line includes alternating-current motors for two-phase and three-phase circuits in capacities from ½ hp. to 500 hp., for all commercial voltages and frequencies, and direct-current motors from ½ hp. to 150 hp. The Fairbanks Company will also cooperate with the various Lincoln district offices in connection with the sale of the manufacturer's other products. The Lincoln Electric Company is one of the largest manufacturers of alternating-current industrial motors in the United States.

THE AMERICAN STEAM CONVEYOR CORPORATION, Chicago, announces that the Atlas Machinery & Supply Company is now handling the sales of the American steam ash conveyor in its St. Louis territory. This company has offices at 1416 Syndicate Trust Building, St. Louis, Mo., and is a new sales organization in that vicinity. It is headed by William H. Patton, who recently returned to the United States after two years' service in the army. Associated with Mr. Patton is his brother, W. R. Patton, who for the last twenty years has traveled the Central West, engaged in the sales of power plant equipment. During the past four years he has represented several of the large manufacturers as district manager. N. B. Stewart, who has been identified with the power-plant machinery business at St. Louis for twenty-five years, has also associated himself with this company.

CANADIAN HEATING DEVICE COMPANIES CONSOLIDATE.—The Canadian Edison Appliance Company, Ltd., has been formed in Toronto, Canada, as of Jan. 1, 1920, to consolidate the manufacturing departments of heating devices of the Canadian General Electric Company, Ltd., and the organization of the Canadian Hotpoint Electric Heating Company, Ltd., and the Hughes Electric Heating Company, all of Toronto, Ont. This new Canadian enterprise will continue to manufacture the complete line of heating and cooking devices that have been manufactured in the past by the above-named companies. The new company states that its purpose is to sell all the complete lines and carry on the policies of the above companies in the broadest possible manner. J. R. Richardson is managing director, F. M. Dusenberry sales manager, F. R. Goldsmith working manager, R. S. Morgan secretary and treasurer, and W. P. Young purchasing agent. Early in 1920 the Canadian Edison Appliance Company, Ltd., will open its new works in Stratford, Ont. The general offices are now at 25 Brant Street, Toronto, Ont.

Supply Jobbers' Notes

THE HATFIELD ELECTRIC COMPANY, Indianapolis, Ind., dealer and contractor enlarged its activities on the first of the year to include those of supply jobber. Three salesmen will be put on the road to cover the Indiana territory, handling appliances and other electrical materials.

THE REVERE ELECTRIC COMPANY, electrical supply jobber, which was started recently in Chicago, has Van M. Marker as president and F. R. Eiseman as secretory and treasurer. Both of these men have been active in the Chicago electrical trade for a number of years. Mr. Marker was for ten years in charge of the Adams-Bagnall Electric Company's Chicago office, and Mr. Eiseman was city sales manager for the Electrical Appliance Company, Chicago, for fifteen years. The new concern has 13,000 sq.ft. of floor space at 439 Plymouth Court and is distributer of Buckeye lamps.

W. W. WILLIAMSON has been appointed general manager of the Alpha Electric Company, 151 West Thirtieth Street, New York City, vice J. H. Hughes, resigned. Mr. Williamson was formerly sales manager of the Alpha company.

JAMES H. HUGHES, who resigned as general manager of the Alpha Electric Company, Inc., has become secretary of Crannell, Nugent & Kranzer, Inc., 110-112 West Thirtieth Street, New York City. His long experience in the electrical supply field, covering a period of more than a score of years, has brought him in contact with the

JAMES H. HUGHES

trade generally. The company has already outgrown its present location, finding it necessary to store its surplus stock in nearby lofts. Crannell, Nugent & Kranzer, Inc., sells only at wholesale, says Mr. Hughes.

Foreign Trade Notes

COMBINE IN BRITISH MOTOR INDUSTRY.—Harper, Bean, Ltd., has been formed in London to include A. Harper & Sons & Bean, iron founders; Vulcan Motor & Engineering Company, Swift, the British Motor Trading Corporation, Steel Manufacturers of Sheffield and a number of subsidiary manufacturers of electric lighting and starting sets.

INSTALLATION MATERIAL IN SWEDEN.—A meeting of manufacturers of and merchants in the electrical installation and lighting glass branches was held in Stockholm a short time ago, when the scarcity of materials in these departments was discussed. The scarcity was attributed partly to the dearth of fuel which prevented the production of porcelain and glass, and partly to the non-arrival of imports which were expected from other countries.

CHARLES H. CHAMPION, 347 Fifth Avenue, New York City, purchasing agent for some British houses, announces that a large company in England, with a branch office in the United States for the purpose of looking after shipments and completing purchasing transactions, etc., desires to be placed in touch with manufacturers of electrical labor-saving appliances, with a view to their sale in the United Kingdom. It is particularly interested in washing machines, electrical clothes driers, vacuum cleaners, dish-washing machines, motor-driven sewing machines, electrical water heating apparatus, electrical automobile accessories, electrical fixtures and fittings and good salable novelties suitable for trade in the United Kingdom. Articles of the higher class and in large quantities are wanted.

VICKERS, LTD. - BROWN - BOVERI ARRANGEMENT LIMITS EUROPEAN COMPETITION.—It is understood that the working arrangements recently made between the firm of Vickers, Ltd., and Brown, Boveri & Company, Baden, Switzerland, covers not only British business but also the British colonies and certain European countries. The Vickers company has acquired the sole British and colonial rights in all the patents of Brown, Boveri & Company, Ltd., and the latter firm undertakes to conduct no direct business in any part of the British Empire. In addition, direct combination is to take place between the subsidiary undertakings of both companies in France and Italy. Vickers, Ltd., has also purchased shares in the Brown, Boveri Company to the amount of £280,000. The arrangement will lessen the risk of competition of continental firms, as there are now only two neutral manufacturers who are capable of building large generating sets such as those required by the Edinburgh Corporation.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A company in Greece (No. 31,217) desires to secure agencies from manufacturers for the sale of electric motors and other electric machinery and appliances, telephones, etc.; plain and insulated electric cables and wires.

A company in England (No. 31,166) desires to purchase electrical fittings and appliances, steel-enamel conduits for electrical wires, and teak blocks for mounting switches. Quotations should be given c.i.f. English port.

A business man in Spain (No. 31,196) desires machinery for making filament electric lamps. Quotations should be given c.i.f. Spanish port. Payment preferably by irrevocable credit in any Spanish bank. Correspondence may be in English.

The general purchasing agent of a firm in Spain (No. 31,190) desires to purchase and secure an agency for electrical measuring instruments (meters), and electrical equipment of all kinds. Quotations should be given c.i.f. Spanish port. Correspondence should be in Spanish.

Riera, Toro & Van Twistern, Inc., manufacturers' agents at 82 Beaver Street, New York City, and Havana, Cuba, having an established trade in Cuba, are desirous of making connections with reliable manufacturers of all types of electrical table, boudoir and floor lamps, fixtures and lighting specialties.

An electrical goods merchant in Spain (No. 31,146) desires to purchase and secure an agency for the sale of raw and insulated materials for electrical construction and repair shops, high-tension apparatus, telephones, porcelain insulators, copper wires, and copper in bars and sheets. Quotations should be given c.i.f. Spanish port. Payment, cash against documents. Correspondence may be in English.

Trade Publications

INDICES.—The General Electric Company has issued indices to its descriptive bulletins and sheets and to its supply part bulletins, dated October, 1919.

ELEVATORS.—The Warner Elevator Manufacturing Company of Cincinnati, Ohio, is issuing, in loose-leaf form, a bulletin covering its electric equipment for traction elevators.

ENTRANCE SWITCHES.—The Trumbull Electric Manufacturing Company of Plainville, Conn., has published circular No. 46 to tell about its "Circle T" externally operated entrance switches and meter protective trim.

INDUCTION FURNACE.—Bulletin No. 9, entitled "Some Results Obtained in Electric Heating with High-Frequency Induction," has been issued by the Pyrolectric Instrument Company, 636 East State Street, Trenton, N. J.

RADIANT HEATERS. — The Majestic Electric Development Company, 1705 Allegheny Avenue, Philadelphia, is circulating a folder describing its new radiant automobile radiator and engine heater, its current determinator, and several styles of its radiant electric household heaters.

WINDING MACHINES.—Bulletin No. 1214 on winding machines and coil winding apparatus has been issued by the Belden Manufacturing Company, Twenty-third Street and Western Avenue, Chicago, in advance of its catalog No. 8. New machines not previously listed are shown in the new bulletin.

VENTILATING FANS.—"Scruplex" electric ventilating fans and exhausters are covered in a sixteen-page bulletin No. 58, which has been published by the L. J. Wing Manufacturing Company, 352 West Thirteenth Street, New York City.

HOUSEHOLD APPLIANCES. — The Western Electric Company of New York City has issued an illustrated booklet entitled "The Eight-Hour Day in the Home," showing how time and labor may be saved in the home through the use of electrical household appliances.

FARM EQUIPMENT.—A thirty-two-page illustrated booklet entitled "The New Farm Help," is a recent publication of the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., and sets forth more than seventy uses to which electric power may be put on farms.

ELECTRICALLY HEATED STEAM DEVICES.—The Bennage Company, 322 Euclid Avenue, Cleveland, Ohio., has issued a bulletin describing the Sepco system of electrically generating steam for heating devices. This system is made by the Steam Electric Products Company of Cleveland, Ohio.

RADIO EQUIPMENT. — The Wireless Specialty Apparatus Company, Boston, has issued an eighty-three-page catalog of its products. The catalog includes a valuable series of tables bearing upon the relation of natural wave-length, frequency and inductance-capacity product in condenser circuits, prepared by Greenleaf W. Pickard, consulting engineer of the company, and formulas for the calculation of radio phenomena, collected by William H. Priess, chief engineer.

ELECTRIC STEEL FURNACES.—Two-phase two-electrode furnaces are discussed in a new bulletin entitled "The Improved Booth-Hall Furnace" issued by the Booth Electric Company, 53 West Jackson Boulevard, Chicago. This bulletin discusses the two-phase furnace as a general pitless furnace, taking up its special shell, the shallow bath, the hearth construction, the auxiliary electrode, speedy melting, mechanical features, electrical features, cost of operation, and rating.

New Incorporations

THE WILDER (MINN.) RURAL ELECTRIC COMPANY has been incorporated with a capital stock of $20,000 by Henry Keffler and others.

THE NEEDVILLE (TEX.) GIN & LIGHT COMPANY has been incorporated with a capital stock of $45,000 by Edward Rinsinger, Henry Banker and M. E. Cloud.

THE MASON-BRACKEN ELECTRIC COMPANY of Germantown, Ky., has been organized to supply electricity for lamps and motors in Brooksville. H. L. Corliss is president.

THE WYNONA (OKLA.) LIGHT & POWER COMPANY has been incorporated by Frank Watson of Wyonna, William Watson of Lometa, Tex., and F. M. Overless of Bartlesville. The company is capitalized at $50,000.

THE NATIONAL INSULATING COMPANY of Parkersburg, W. Va., has been incorporated by J. Marshal, C. D. Forrer and M. E. Hiehle. The company is capitalized at $40,000 and proposes to manufacture insulating equipment.

THE NORTHWEST ELECTRIC APPARATUS COMPANY of Minneapolis, Minn., has been incorporated by John A. Clark, 1806 Park Avenue, Minneapolis. The company is capitalized at $30,000 and proposes to deal in electrical supplies.

THE STEINMETZ ELECTRIC MOTOR CAR COMPANY of Baltimore, Md., has been incorporated with a capital stock of $2,000,000 to establish a large assembling plant for electric trucks and light motor cars. Dr. Charles P. Steinmetz of Schenectady, N. Y., is interested in the project.

THE BROADALBIN (N. Y.) SUPPLY & CONSTRUCTION COMPANY has been incorporated with a capital stock of $25,000 to do general contracting and wiring work, and to deal in electrical fixtures, appliances and machinery, doing business under the same management and in the same offices in Broadalbin and Northville as the Broadalbin Electric Light & Power Company. The officers are: William Pierson Judson, president; Henry C. Finch, secretary and treasurer, and Thomas D. Drought, manager, all of Broadalbin.

New England States

DAMARISCOTTA, ME. — The Lincoln County Power Company is installing a 750-hp. wheel and a 560-kva. generator at Damariscotta Mills to replace the 200-kva. generator now in use. E. S. Lincoln is treasurer and manager.

OLD TOWN, ME.—The local electric light plant and water-pumping station of the Bangor Railway & Electric Company was recently destroyed by fire, causing a loss of about $75,000. The company, it is said, is making arrangements to rebuild same.

CLAREMONT, N. H.—The W. H. McElwain Company is contemplating building an addition to its shoe plant at Claremont and the construction of a power house at Newport.

PORTSMOUTH, N. H. — Preparations are being made by the Rockingham County Light & Power Company for a hydroelectric development on the Lamprey River in the town of Durham. It is proposed to raise a present dam 18.5 ft. high to a height of 35 ft. and by means of canal and headworks to gain 15 ft. further, locating a plant just below Parkers Falls. The Rockingham company has built a tie line from the Portsmouth station which will be used in connection with the Lamprey River development. It is planned to install two water wheels taking 550 cu.ft.-sec. each and in the dam two Tainter gates, each 22 ft. long by 14 ft. high, capable of caring for from 7,000 to 8,000 cu.ft.-sec. The present development in Durham was formerly owned by the Newmarket Electric Company.

NORWOOD, MASS.—Orders have been placed for two 2,000-kw transformers to replace two 1,000-kw. now in use in the municipal lighting system. F. S. Barton is superintendent.

TAUNTON, MASS.—The installation of a new 4,000-kw. turbo-generator in the municipal electric light plant is under consideration. Warren B. Lewis is manager.

Middle Atlantic States

ARCADE, N. Y.—The Village Council is contemplating the installation of a 250-hp. water-tube boiler, pumps and heater in the municipal electric light plant; also the erection of a transmission line to Sandusky and some rural lines. L. A. Mason is clerk.

BATAVIA, N. Y.—The Genesee Light & Power Company has petitioned the Public Service Commission for permission to erect electric transmission lines to South Byron and Byron to supply electricity for lamps and motors in those towns.

COOPERSTOWN, N. Y.—Contract has been placed by the Southern New York Power Company for a 500-kw., 60-cycle, 2,300-volt turbo-generator for its Walton plant. C. L. Stone is vice-president and general manager.

DANSVILLE, N. Y.—The Dansville Gas & Electric Company is contemplating changing its system from 133 cycles to 60 cycles. Not yet decided when the change will be made. C. H. Mason is superintendent.

FRANKLIN, N. Y.—The Delaware & Otsego Light & Power Company contemplates installing an auxiliary steam plant to furnish power through the dry season; also the erection of from 6 to 10 miles of new transmission line and rebuilding the present transmission system as far as possible. E. A. Mackay is president and manager.

HILTON, N. Y.—Plans have been completed by Peck & Pratt, Inc., for the erection of a new power plant to be used for operation of its proposed cannery works.

NEW YORK, N. Y.—The Interborough Rapid Transit Company contemplates the construction of a substation for its Westchester branch at Westchester Avenue, near St. Peters Avenue, to cost about $50,000.

NORWOOD, N. Y.—The Norwood Electric Light & Power Company contemplates the installation of a generator and waterwheel and construction of new wheel pits. Cortes F. Vance is manager.

NUNDA, N. Y.—The Nunda Electric Light Company contemplates increasing its power plant (for standby service only) from 125 kva. to 250 kva. Orders have been placed for transformers for substation which will double the present capacity. A. J. Woodworth is president.

PORT LEYDON, N. Y.—The Port Leydon Electric Light & Power Company contemplates the installation of a new generator. Louise E. Wilson is owner.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

WATERTOWN, N. Y.—Plans have been prepared by the Northern New York Utilities, Inc., for an addition to its local electric plant. The company has applied to the Public Service Commission for permission to extend its line to Clifton and for an approval of a franchise granted by that town.

WELLSVILLE, N. Y.—The Water and Light Department is contemplating the installation of a 300-kva. turbo-generator in the municipal electric light plant. C. F. Schermerhorn is superintendent.

BELVIDERE, N. J.—The Warren Wood Working Company contemplates the installation of a new generator in its hydroelectric plant. Paul E. Widener is superintendent.

CHATHAM, N. J.—The installation of a 180-kva. generating unit, directly connected, in the municipal electric light plant is under consideration. Theodore T. Haldeman is superintendent.

LAKEWOOD, N. J.—The Lakewood & Coast Electric Company contemplates the installation of a 1,500-kva. General Electric three-phase, 2,200-volt turbine and increasing its transformer capacity. A. S. Phelps is manager.

WEEHAWKEN, N. J.—Large quantities of electrical and mechanical equipment will be required in connection with the proposed dry dock and ship repair plant of the Weehawken Dry Dock Company, foot of Baldwin Street, on property recently acquired on the Hudson River at North Bergen and Guttenberg.

BOILING SPRINGS, PA.—The Boiling Springs Electric Light & Water Company contemplates the installation of a 100-kva. Westinghouse three-phase, 60-cycle, 2,400-volt generator. J. C. Bucher is owner and manager.

DUSHORE, PA.—The Sullivan County Electric Company will install a new generator and boiler and will erect 30 miles of transmission lines. H. L. Troxell is general manager.

FORD CITY, PA.—An additional electric generating unit will be installed in the municipal electric light plant. J. H. Mintgens is superintendent.

GROVE CITY, PA.—The installation of an electric generating unit, consisting of a 125-kw. generator directly connected to an oil engine, in the municipal electric plant is under consideration by the municipal electric department; also the erection of a three-phase, three-wire, 2,200-volt transmission line, ¾ mile long. Frank H. Poehlman is superintendent.

ORRTANNA, PA.—The Orrtanna Electric Light & Power Company contemplates the erection of an electric transmission line to Biglerville. The company is now building a line to McKnightstown. S. Z. Musselman is manager.

PHILADELPHIA, PA. — Arrangements have been made by the Philadelphia Storage Battery Company, Ontario Street, for the erection of a three-story addition to its plant, to cost about $50,000.

PITCAIRN, PA.—The Council is considering the installation of a gas-engine-driven electric generating unit of about 200-kva. capacity in the municipal electric light plant. M. H. Stout is secretary.

PITTSBURGH, PA.—Plans have been completed by the Spang Chalfant Company of Etna for the construction of a new substation at its plant. Henry Chalfant is president.

WILLIAMSTOWN, PA.—The Lykens Valley Light & Power Company contemplates the erection of 5 miles of three-phase transmission line. J. B. Whitworth is manager.

CLAYMONT, DEL.—Plans have been perfected by the Worth Brothers Steel Company for extensive additions to its plant, to cost about $2,000,000. The work will include the construction of a new rolling mill, the installation of furnaces, shear equipment, rolling-mill machinery, electrically operated traveling cranes, etc. Norman R. Entrekin is general superintendent.

NEW CASTLE, DEL.—The Wilmington & Philadelphia Traction Company of Wilmington contemplates the installation of additional equipment at its local station.

OCEAN CITY, MD.—The Delmarvia Utility Company contemplates the installation of a 125-kw. generator and the erection of 1 mile of 2,400-volt, three-phase transmission line. Henry T. Moore is manager.

OXFORD, MD.—The Town Council has approved a bond issue for $18,000 for the construction of a new municipal electric light plant.

ELKINS, W. VA.—The Elkins Power Company contemplates the installation of a new generating unit. C. C. Bosworth is manager.

HUNTINGTON, W. VA.—The Ohio Valley Electric Railway Company is making a new survey for its proposed 11,000-volt transmission line from Kenova to Huntington and a 11,000-volt line from the Third Street substation to the Eighteenth Street East station. W. R. Power is general manager.

KANAWHA CITY, W. VA.—Plans are being considered by the Libby-Owens Sheet Glass Company for additions to its local plant, to be equipped with glass-making and general operating machinery, to cost about $2,000,000.

LOGAN, W. VA.—The Kentucky & West Virginia Power Company is now enlarging its local plant and will install this year one 15,000-kw. turbine and two additional boilers of 1,000 hp. each. F. R. Weller of Washington, D. C., is chief engineer.

MORRISVALE, W. VA.—The Royal Block Coal Company, it is reported, will rebuild its power house, recently destroyed by fire. The loss is estimated at $20,000

PHILLIPI, W. VA.—The installation of an 800-hp. steam turbine in the municipal electric light plant is under consideration. A. D. Poling is manager.

BASIC, VA.—The installation of additional power equipment in the municipal electric light plant is under consideration. J. F. Rhodes is chairman of finance committee. M. E. Swontzel is manager.

North Central States

BROOKLYN, MICH.—A special election will be called to submit to the voters the proposal to issue bonds for the construction of an electric distribution system, to include ornamental lamps for the village square. The Village Council has approved a tentative contract for a franchise to the Hydroelectric Development Company of Liberty Mills to supply electricity for lamps and motors in Brooklyn.

EAST JORDAN, MICH.—Plans are being considered by the East Jordan Electric Light & Power Company for rebuilding its power dam on Deer Creek.

ARCANUM, OHIO.—The installation of a boiler in the municipal electric light and water plant is under consideration. C. C. McCool is superintendent.

DAYTON, OHIO.—The Dayton Power & Light Company is reported to be contemplating the installation of a 30,000-hp. steam turbine and two large boilers at its Millers Ford plant. The cost of the proposed work is estimated at about $800,000.

GREENVILLE, OHIO.—The Greenville Electric Light & Power Company contemplates the installation of a 2,000-kw. generator, condensers, two 600-hp. boilers, etc., and also the erection of transmission lines to Hollansburg, Glenkarn and Palestine. W. S. Meeker is secretary.

MARYSVILLE, OHIO.—The Marysville Light & Water Company contemplates the erection of an electric transmission line to New Dover. Mayne Mackan is superintendent.

CARROLLTON, KY.—Bonds to the amount of $25,000 have been voted for improvements to the municipal electric light plant and waterworks system.

MURRAY, KY.—The installation of a 200-kw steam-driven generating unit in the municipal electric light plant is under consideration. J. W. Stitt is manager.

OWINGSVILLE, KY. — The Electric Light Company contemplates the installation of a 50-kw. direct-current generator. E. V. Brother is secretary and manager.

PARIS, KY.—The Paris Gas & Electric Company contemplates the erection of 9 miles of 6,600-volt transmission line. C. L. Steenbergen is manager.

AUBURN, IND.—The Public Service Commission has authorized the city of Auburn to issue $50,000 in bonds, the proceeds to be used for improvements to the municipal electric light and water plant ordered by the commission.

PERU, IND.—The installation of a new 500-hp. boiler in the municipal electric light plant is under consideration. G. C. Anderson is manager.

DECATUR, IND.—Plans are under consideration for building an entire new municipal electric plant, including the erection of a new power house, the installation of a 1,000-kw. turbine, three new boilers, switchboard, spray pond, stokers, ash conveyors and condensers. M. J. Mylott is manager.

CHICAGO, ILL.—The Lincoln Park Commissioners are contemplating installing a new substation, 12,000-volt transmission, three-phase, 60 cycle; two 3,000-gal. centrifugal pumps driven by a 1,800-r.p.m., 4,000-volt, three-phase induction motors; two 300-kva. 12,000/4,000/2,300-volt, three-phase transformers; one three-phase, four-wire, 2,300/400-volt circuit; three single-phase, 2,300-volt regulated multiple lighting circuits; twelve 7.5-amp, 5,000-volt circuits; storage battery; motor-generator unit; local power and lighting panels and transformers, and probably large flood-lighting installations and concrete post drive lighting. C. H. Shepherd is electrical engineer in charge.

SAVANNA, ILL.—The People's Gas & Electric Company is considering the installation of an additional boiler and generating equipment, the erection of 10 miles of transmission lines and installing substation apparatus. F. P. Bowen is manager.

GREENWOOD, WIS.—The Municipal Light and Power Department contemplates extensions to its high-tension line and the erection of 16 miles of rural lines to furnish electricity to the farming districts. G. V. Rork is superintendent.

KAUKAUNA, WIS.—The Municipal Electric Light and Water Departments are considering the construction of a new dam and a 7,000-hp. hydroelectric plant. A transmission line to connect with the system of the Wisconsin Traction, Light, Heat & Power Company is now under construction. J. O. Posson is manager.

LOWELL, WIS.—The Lowell Light & Power Company contemplates the installation of a vertical alternator. W. F. Pease, Jr., is secretary and treasurer.

MANITOWOC, WIS.—The Public Utilities Commission is contemplating the purchase of an additional generator for the municipal electric light plant within the next year or two. W. C. Steaffler is secretary and purchasing agent.

MILWAUKEE, WIS.—The Public Sewerage Commission is planning to build a steam-driven electric generating plant in connection with the Jones Island sewage disposal plant project. The plans provide for a development of 11,700 hp., at an estimated cost of $1,250,000. Specifications are being prepared for three types, coal-burning boilers, oil-burning boilers and internal-combustion engines. T. Chalkley Hatton is chief engineer.

OSSEO, WIS.—The property of the Osseo Electric Company has been purchased by the Augusta (Wis.) Light & Telephone Company. The new owner will erect a transmission line from Augusta to Osseo. Energy will be obtained from the Wisconsin-Minnesota Light & Power Company. S. E. Lee is manager of the Osseo company.

COLUMBUS JUNCTION, IOWA.—The Louisa County Power Company contemplates the erection of about 40 miles of transmission lines. R. L. Van Meter is president and manager.

DUBUQUE, IOWA.—At an election to be held Jan. 26 the proposal to establish a municipal electric light plant in Dubuque will be submitted to the voters.

HAWARDEN, IOWA.—The installation of a 200-kva. generator and engine and boilers in the municipal electric light plant is under consideration by the Electric Light and Water Department; also the erection of rural lines and lines in streets not now served. Otto Pyles is manager.

PERSIA, IOWA—The local electric light plant, owned by J. G. Cave, was recently destroyed by fire, causing a loss of about $7,000.

GREENFIELD, MO.—The water, electric light and ice plants, controlled by Lee Brothers of Kansas City, were recently destroyed by fire, causing a loss of about $20,000.

HUNTER, N. D.—The Hunter Light & Power Company is considering the installation of an 80-hp. oil engine-driven generating unit. As yet nothing definite has been decided upon. J. B. Hockridge is president.

MAYVILLE, N. D.—Plans are under consideration for improvements to the municipal electric light plant. Estimates will be submitted by R. W. Richards of the Western Equipment Company, 63 East Sixth Street, St. Paul, Minn.

ANSLEY, NEB.—The installation of an additional 100-hp. generating unit in the municipal electric light plant is under consideration by the village of Ansley. J. A. Barker is chief engineer.

AUBURN, NEB.—The Intermountain Railway, Light & Power Company contemplates the installation of one 310-hp. Nordberg Corliss engine with a 200-kw. General Electric three-phase, 60-cycle generator. N. H. Coit is local manager.

CHANUTE, KAN.—Extensive improvements are contemplated to the municipal electric light plant, including the erection of new engine room, a spray pond for cooling water and the installation of a 500-kw. turbo-generator and one 250-hp. Heine boiler. H. R. Williams is superintendent.

KANSAS CITY, KAN.—Plans are under consideration by the Kansas City (Mo.) Railways Company for the construction of a power plant on James Street, Kansas City, Kan., to cost about $27,000.

ONAGA, KAN.—Plans are being prepared for the installation of an electric lighting system at the County Home. Bids, it is understood, will soon be asked by the County Comissioners.

Southern States

HOBGOOD, N. C.—Plans are under consideration by the town of Hobgood to erect an electric transmission line to the town of Scotland Neck, a distance of about 7 miles, to secure electricity from the municipal electric plant there to operate the proposed local municipal lighting system. The cost of the distributing system and transmission line is estimated at about $20,000.

JACKSONVILLE, N. C.—Bids will be received by the town of Jacksonville until Feb. 17 for construction of sewer system and waterworks, consisting of 11,000 ft. of sewer pipe, and 12,000 ft. of water mains, together with a 60,000-gal. tank on tower, a 60,000-gal. reservoir, steam-driven electric generating and pumping equipment and appurtenances. Plans and specifications are on file at the office of the town clerk, Jacksonville, and the Carolina Engineering Company, Southern Building, Wilmington, N. C.

ZEBULON, N. C.—Improvements and extensions are contemplated to the municipal electric lighting system, including the installation of a complete generating unit and erection of a transmision line to Wakefield. R. E. Ward is manager.

SMITHVILLE, GA.—The Council is considering calling an election to submit to the voters the proposal to issue bonds for the construction of an electric light, water and sewer systems.

WAYNESBORO, GA.—Improvements to the municipal electric light plant and waterworks system, to cost about $25,000, are under consideration.

PALM BEACH, FLA.—Extensions and improvements are contemplated by the City Council to the electric lighting system, to cost about $10,000.

SPRUCE PINE, ALA.—The Spruce Pine Sand & Gravel Company is planning to install a generating plant, boilers and pumping equipment in connection with its proposed works, consisting of a hydraulic gravel washing and screening plant. James A. Barr of Mount Pleasant, Tenn., is construction engineer. Charles B. Crow is treasurer and general manager.

BUNKIE, LA.—The Bunkie Ice Company contemplates the installation of a 150-hp. crude-oil-engine-driven unit. C. J. Pope is vice-president and general manager.

BROKEN ARROW, OKLA.—The Public Service Company of Oklahoma, Tulsa, contemplates the erection of an electric transmission line from Broken Arrow to Tulsa.

GRANDFIELD, OKLA.—The Grandfield Light & Power Company is making improvements to its plant, including the installation of a 225-hp. Skinner engine, one 200-kva. General Electric alternating-current generator, ten transformers, from 5 to 15 kva. Contract has already been awarded. Fred Dorse is engineer in charge of the work. J. S. Green is manager.

HOBART, OKLA.—Plans are being prepared by the V. V. Long Company, engineer, Colcord Building, Oklahoma City, for a municipal electrict light plant. An election will soon be held to vote on the proposal to issue $35,000 in bonds for project.

LUFKIN, TEX.—The City Commissioners are considering asking for bids for the installation of an ornamental lighting system in the business district.

Pacific and Mountain States

OLYMPIA, WASH.—Plans are being prepared by Wilder & White, architicts for the new Capitol group of buildings, for a power house, to cost about $183,000. Bids for the new building, it is understood, will be opened early in February.

ASTORIA, ORE.—Bids will be received by the State Highway Commission, Multnomah County Court House, Portland, Ore., until Feb. 5 for construction of one double-leaf trunnion bascule bridge with approaches and appurtenant works, including miscellaneous electrical and other equipment, on the Columbia Highway across Young's Bay, near Astoria. Plans and specifications may be obtained at the office of the State Highway Commission and the State Highway Engineer, State House, Salem, upon deposit of $10. Herbert Nunn is state highway engineer.

ASTORIA, ORE.—The Pacific Power & Light Company is planning to install additional equipment at its Youngs Bay station, including one 3,759-kva. General Electric steam turbine, switchboard to control turbo-generator and feeder panels, three 1,000-kva., single-phase 24,000/2,200-volt Westinghouse transformers, the erection of one substation, also the installation of three 150-kva., 6,600/11,400/220/440-volt transformers and three 333-kva., 6,600/22,000-volt transformers at Port Dock. The Phoenix Utility Company is contractor. H. H. Schoolfield, 409 Gasco Building, Portland, is engineer in charge.

ONTARIO, CAL.—Plans are under consideration by the Edison Electric Appliance Company for extensions to its plant. The company manufactures Hot Point electric heating and cooking appliances.

ROSEVILLE, CAL.—The Pacific Fruit Express Company is planning to utilize electricity instead of steam for operating the ice-manufacturing machinery for its refrigerating plants.

SAN JOSE, CAL.—The Security Warehouse & Distributing Company of San Jose is planning to erect an ice and cold storage plant, to cost with equipment about $500,000.

Canada

MILLTOWN, N. B.—The Canadian Cottons, Ltd., will construct a new dam and hydroelectric power house, equipped with three vertical units, replacing its present plant. R. S. Kelsch, Power Building, Montreal, Que., is consulting engineer.

ST. JOHN, N. B.—Preparations are being made by the Cornwall & York Cotton Mills Company, Ltd., of St. John for the construction of a new power house and engine room, which will be equipped with water-tube boilers, turbo-generator, switchboard, cooling pond, etc. Two units of 750 kw. will be installed. R. S. Kelsch, Power Building, Montreal, Que., is consulting engineer.

CORNWALL, ONT.—The Canadian Cottons, Ltd., will construct a new hydroelectric power house in Cornwall, immediately west of its Stormont Mills. The power house will be equipped with three vertical shaft units of 1,000 kw. capacity. The company also contemplates installing a new unit consisting of water-tube boilers steam turbine and necessary auxiliaries in its new steam turbo-generator plant. R. S. Kelsch, Power Building, Montreal, Que., is consulting engineer.

HAMILTON, ONT.—Arrangements are being made by the Ontario Mills of Hamilton for the installation of a new 12,000-hp. steam-boiler plant, equipped with water-tube boilers, coal and ash-handling machinery, heaters, pumps, piping, etc. R. S. Kelsch, Power Building, Montreal, Que., is consulting engineer.

DESCHAMBAULT, QUE.—The Portneuf Hydraulic Company will install two units of 1,000 kw. each at its plant this year. Henri Paré is manager.

Miscellaneous

PETERSBURG, ALASKA.—At an election held recently the proposal to issue $75,0000 in bonds to establish a municipal electric light plant was carried.

PANAMA—Bids will be received at the office of the general purchasing agent of the Panama Canal, Washington, D. C., until Jan. 30 for steel tubing, sheet copper, copper ferrules, cable thimbles, platform scales, pulleys, bilge pumps, electroplating supplies, etc. Blanks and further information relating to this crcular (1335) may be obtained from the above office.

Record of Electrical Patents

Notes on United States Patents

(Issued Dec. 30, 1919)

1,326,794. METHOD AND MEANS FOR THE UTILIZATION OF THE THERMIC EFFECT OF CATHODE RAYS; Alf Sinding-Larsen, Vestre Aker, near Christiania, Norway. App. filed Oct. 30, 1918. Focusing cathode rays at small opening heating chamber, and heating object in chamber beyond focus rays.

1,326,864. SELECTIVE CONTROLLING APPARATUS FOR ELECTRIC CIRCUITS; Henry F. Herman, Pleasantville, N. Y. App. filed March 7, 1916. Adapted to electromagnetically operated mechanism.

1,326,882. APPARATUS CONTAINER; Harry F. Stratton, Cleveland, Ohio. App. filed May 3, 1917. Casing with cover and set of eye bolts and ring bolts.

1,326,891. ELECTROPLATING AND ELECTROCLEANING APPARATUS; Andrew Ness, Glasgow, Scotland. App. filed Nov. 22, 1919. Rotating drum with concentric aperture.

1,326,895. TIMING APPARATUS; Daniel S. Holt, Mittineague, Mass. App. filed Feb. 5, 1919. Indicates proper time for ejection of charge from receiver.

(Issued Jan. 6, 1920)

14,787 (reissue). DYNAMO-ELECTRIC MACHINERY; Leigh J. Stephenson, Chicago, Ill. App. filed Dec. 10, 1919. Produces dynamical braking effect.

1,326,912. METHOD OF WELDING; Spencer C. Cary, Brooklyn, N. Y. App. filed April 6, 1916. For box strapping.

1,326,924. LAMP-LOCKING CONSTRUCTION; Edgar H. Freeman, Trenton, N. J. App. filed July 2, 1918. Locking mechanism concealed.

1,326,952. OZONIZING APPARATUS; Payton J. H. Moore, Chicago, Ill. App. filed March 1, 1917. High voltage passed through coils on glass plates.

1,326,955. MUSICAL INSTRUMENT; Elmer F. Mueller, Chicago, Ill. App. filed May 21, 1917. Combines features of piano and phonograph.

1,326,962. SECTIONAL NON-ROTATIVE INSULATING KNOB FOR SUPPORTING ELECTRIC WIRES; Alfred M. Poindexter, Denver, Col. App. filed May 1, 1917. Frictional engagement with bulged sides of nail.

1,326,964. WATER HEATER; Fred Poole, Jewell, Kan. App. filed Feb. 9, 1915. Resistance wound within closed-loop pipe.

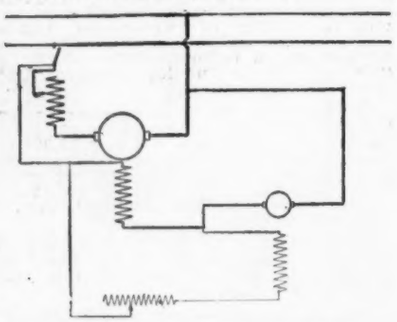
1,326,968. PROCESS OF EXTRACTING OILS FROM FATTY SUBSTANCES; George D. Rogers, Gloucester, Mass. App. filed March 7, 1919. By electrolytic action.

1,326,972. ANODE FOR ELECTRIC VACUUM APPARATUS; Moritz Schenkel, Charlottenburg, Germany. App. filed Sept. 13, 1916. Annular anode built up from a number of sections.

1,326,983. PORTABLE ELECTRIC LIGHT; Frederick G. Spiers, Jamaica, N. Y. App. filed Nov. 29, 1918. Casing with heavy layer of fiber insulation.

1,326,994. TELAUTOGRAPHIC APPARATUS; George S. Tiffany, Summit, N. J. App. filed Dec. 15, 1917. With receiver-selecting mechanism.

1,327,009. ELECTRIC SWITCH; William E. Andree, Chicago, Ill. App. filed June 7, 1916. Two telescoping members both reciprocable along a line.



14,787—Dynamo-Electric Machinery

1,327,017. ELECTRIC POCKET LAMP; Conrad Boltshauser, Zurich, Switzerland. App. filed Oct. 23, 1917. Flat cylindrical shape with carbon and zinc battery.

1,327,023. ELECTRICAL APPARATUS FOR THE ELECTROCHEMICAL TREATMENT OF LIQUID HYDROCARBON AND OTHER COMPOUNDS; Louis B. Cherry, Kansas City, Mo. App. filed Feb. 26, 1916. Avoids cracking and destructive distillation.

1,327,046. ELECTROMAGNETIC BRAKE; Henry V. James, Radlett, England. App. filed Sept. 18, 1917. For material feed reels; used with textile, paper-making and printing machinery.

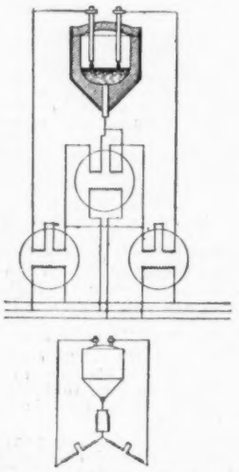
1,327,050. STAMPING MACHINE; Bernard S. Lee, Beverly, Mass. App. filed Sept. 6, 1917. Power-driven shoe-marking machine.

1,327,094. ELECTROLYTIC CELL; Alvah M. Griffin, Kansas City, Mo. App. filed Aug. 24, 1918. Maximum volume of gas generated in given time.

1,327,102. SHERARDIZING APPARATUS; Charles J. Kirk, New Castle, Pa. App. filed March 1, 1919. Rotary retort with both external and internal heating units.

1,327,121. SELF-FILLING STORAGE BATTERY; Norman D. Sturges, Bellerose, N. Y. App. filed Aug. 6, 1919. Storage tank above battery.

1,327,124. SIGNALING DEVICE FOR MOTOR VEHICLES; Milton Tibbetts, Detroit, Mich. App. filed Feb. 18, 1916. Varies degree of vibration in horn.



1,327,174—Three-Phase Electric Furnace.

1,327,129. DRIVE GEARING; Fay M. Wolff, Louisville, Ky. App. filed Aug. 23, 1918. For self-propelled chairs.

1,327,132. ENGINE STARTER; Vincent Bendix, Chicago, Ill. App. filed Sept. 25, 1916. Hollow armature shaft with driven shaft within.

1,327,135. RHEOSTAT; William L. Bliss, Niagara Falls, N. Y. App. filed May 13, 1918. Manual adjustment.

1,327,160. ELECTRICALLY DRIVEN SPINDLE; Josef Hurtig, Rochester, N. Y. App. filed Jan. 8, 1919. For woodworking machines.

1,327,174. THREE-PHASE ELECTRIC FURNACE; Frederick T. Snyder, Oak Park, Ill. App. filed March 11, 1918. Has only two carbon electrodes and a bottom contact.

1,327,185. TELEPHONE SYSTEM; Donald F. Whiting, New York, N. Y. App. filed Dec. 28, 1918. For high-frequency signaling currents.

1,327,207. METHOD OF CONTROLLING TEMPERATURES; Tiodolf Lidberg, Chicago, Ill. App. filed Jan. 9, 1919. For bacteriological research work and orificial surgery.

1,327,234. STORAGE-BATTERY ELEMENT; Eugene Handler, Newark, N. J. App. filed May 5, 1916. Spacing prevents buckling.

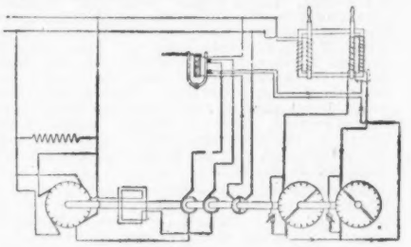
1,327,267. PROCESS OF WELDING; Leon B. Brewster and Frank Weisehan, Cleveland, Ohio. App. filed Dec. 7, 1917. For filling blow-holes.

1,327,274. STREET INDICATOR FOR TRAMCARS; Henry S. Evans, East Chicago, Ind. App. filed April 18, 1916. Operates by contactor engaging with trolley.

1,327,279. ELECTRICAL RADIATOR HEATER; William Hurst, Winnipeg, Manitoba, Canada. App. filed Jan. 17, 1918. Pipe containing resistance.

1,327,280. PICTURE-PROJECTING APPARATUS; Charles F. Jenkins, Washington, D. C. App. filed Oct. 17, 1916. Carbon arc and distance from condensing lens adjustable.

1,327,282. HERMETIC UNIT SMELTING SYSTEM; Woolsey McA. Johnson, Hartford, Conn. App. filed Feb. 18, 1915. Multiple-stage system for smelting and transporting zinc ores.



1,327,521—Rectifier System

1,327,284. CIRCUIT BREAKER FOR MAGNETOS; Paul Labrosse and Felix Esteve, Lyons, France. App. filed May 9, 1918. Provides fiber insulating sleeve between the axle of lever and disk.

1,327,340. ELECTRIC BELL; William D. Lutz, Allendale, N. J. App. filed July 27, 1917. For high-voltage circuits.

1,327,341. METHOD OF DEVELOPING DEFECTS IN METALLIC OBJECTS; Angus S. MacDonald, Great Neck Station, N. Y., and Harry P. MacDonald, Montclair, N. J. App. filed April 13, 1918. Flaws detected by passing current through samples.

1,327,344. INTERRUPTER FOR IGNITION DEVICES; Charles T. Mason, Sumter, S. C. App. filed March 27, 1918. Produces current in secondary circuit for sparking.

1,327,349. HOMOPOLAR MAGNETIC CIRCUIT; Robert V. Morse, Ithaca, N. Y. App. filed Sept. 13, 1917. Light and compact filed magnet structure with uniform flux distribution.

1,327,350. COOLING SYSTEM FOR HOMOPOLAR MACHINES; Robert V. Morse, Ithaca, N. Y. App. filed Sept. 13, 1917. Ventilated field, armature and coils.

1,327,352. TELEGRAPH RECEPTOR; William E. Peirce, Newark, N. J. App. filed Jan. 17, 1917. Telephone receiver with amplifying lever.

1,327,361. IGNITION DEVICE; Harry R. Van Deventer, Sumter, S. C. App. filed Oct. 13, 1917. Generator support removed without disturbing electrodes.

1,327,375. IGNITION GENERATOR; William W. Dean, Stamford, Conn. App. filed Aug. 22, 1916. Rotor provides large magnet without increasing diameter.

1,327,409. CONDUIT OUTLET BOX; August H. Schneider, Syracuse, N. Y. App. filed Feb. 7, 1916. For outdoor use.

1,327,412. TELEPHONE; William C. Ude, West Haven, Conn. App. filed Aug. 1, 1917. Adjustable transmitter.

1,327,421. ELECTRIC ELEVATOR-CONTROLLING SYSTEM; Carl S. Brown, Portland, Ore. App. filed Nov. 16, 1915. Push-button control for dumb waiters.

1,327,463. SECTION SWITCH; Harry W. Davis, Edgewood Park, Pa. App. filed June 3, 1918. Automatic safety switches for mine trolleys.

1,327,496. ELECTRIC LAMP SOCKET; Garnett Snider, Bruce Mines, Ontario, Canada. App. filed Sept. 22, 1917. Lamp thrust into socket and twisted to give firm contact.

1,327,500. TELEPHONE SET; Henry Symes, Dunedin, New Zealand. App. filed Nov. 9, 1916. Automatic calling device, transmitter and receiver mounted.

1,327,502. IGNITION DEVICE; Harry Randolph Van Deventer, Sumter, S. C. App. filed Oct. 13, 1917. Including ignition electrodes, a generator and a trip-operated spring mechanism.

1,327,507. INTERNAL-COMBUSTION-ENGINE WATER HEATER; Fred Walther, Omaha, Neb. App. filed Dec. 5, 1918. Heater operated from control board.

1,327,521. RECTIFIER SYSTEM; Henry E. Burket, Kansas City, Mo. App. filed March 29, 1917. Prevents "kick-back" on main commutator.

1,327,542. ELECTRIC CONDUCTOR; Peter F. Frey, Niagara Falls, N. Y. App. filed May 27, 1918. Prevents creepage in storage batteries.